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SURGERY OF CHILDHOOD

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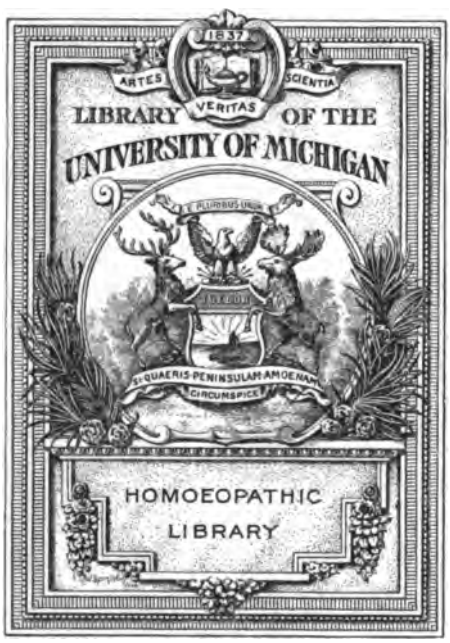

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SURGERY

OF

CHILDHOOD

BY

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1909

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TO MY FRIENDS AND FELLOW MEMBERS

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PREFACE.

In offering this work to the medical profession the writer presents not only the results of his own thirty years' experience, but also what he believes to be the best opinions obtainable on the various subjects as gathered from the study of the most up-to-date writers.

The attempt has been made to present the matter in such a form that it may be readily available by the busy practitioner, who, though he may not be a surgeon himself, desires information as to when and how surgical treatment is indicated.

Illustrations have been inserted freely, because the author believes that they convey a much truer idea of the actual conditions which he wishes to show than can be given by complicated wordy descriptions.

To his colleagues who have contributed such excellent articles on special subjects, the author desires to express his grateful appreciation.

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SURGERY OF CHILDHOOD

INJURIES.

Children receive many injuries from falls or blows, and often contact with sharp objects causes wounds which are deep and painful. Small wounds usually heal rapidly, but when the face is the site of the cut it may require skilful treatment to prevent a scar, which is noticeable if not disfiguring.

Fortunately face and scalp wounds bleed so profusely that infective matter is washed out by the flow of blood, and with proper approximation, such wounds usually heal by first intention. However, if there is any reason to fear that the object inflicting the injury is infected, it is well to thoroughly cleanse the wound with a $^1/_{2000}$ bichloride of mercury solution, or any other antiseptic solution, as a 2 per cent. solution of carbolic acid, a solution of salt and water, a strong mixture of cider vinegar and water, or witch hazel. The approximation of the edges of the wound may be accomplished in several ways. In some cases an anæsthetic may be required, but often, with sensible children, it may be omitted, as the tissues are rendered more or less insensitive by the injury, and there is very little pain from the passage of the needle.

Small, clean cuts may be drawn together with strips of sterile Z. O. plaster, about 1/6 of an inch wide, which are left in place until healing is complete.

Another way is to take a piece of thin sterilized gauze, or, better still, chiffon, fastening one end at a little distance from

one side of the wound to the skin. Then make traction on the loose end until the edges are perfectly approximated, and fasten it with collodion to the skin. The collodion should then be carried up to within a line of the cut, but not covering it. In this way a very good approximation may be made, and the progress of healing observed through the thin chiffon.

Another method is to apply strips of Z. O. plaster on each side of the cut, and then draw the edges of the plaster together. (Fig. 1.) It is not always easy, however, to get per-

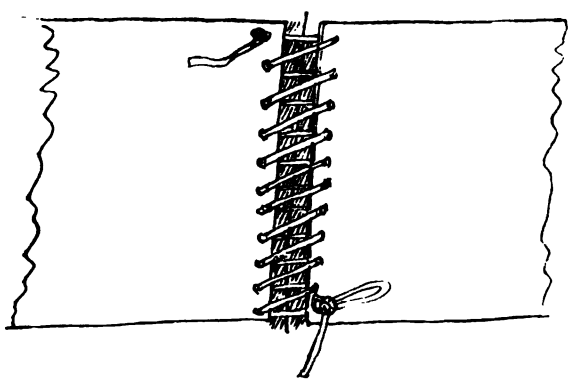


FIG. 1.—Sutures placed in strips of adhesive plaster.

fect approximation by the above described methods if the wound is at all deep, on account of the tendency of the edges to invert and not meet perfectly, and a scar will result. The most perfect approximation and the smallest scar are obtained when sutures are used.

If the wound is deep it is best to draw the deeper portion together with a buried running suture of fine catgut. For the skin, interrupted sutures of sterilized horse hair are the best, although fine sterilized silk, or even linen or cotton thread, may be used with a fine needle and just catching the edges of the skin. Often the combination method of interrupted sutures and narrow strips of sterilized "Z. O." plaster is a good one.

The sutures may be removed in two or three days, but the plaster strips are left on for several days longer, to support the new tissue and to prevent stretching or broadening of the cicatrix. (Fig. 2.) This method is especially applicable to the closure of abdominal wounds to prevent ventral hernia. The closure of such a wound is shown in Fig. 62.

In scalp wounds—union by sutures of silk worm gut—after disinfection is the best.

For the ordinary bumps and bruises the classical application of "vinegar and brown paper" is not bad, but if for the vinegar the ordinary coarse brown wrapping paper is sat-

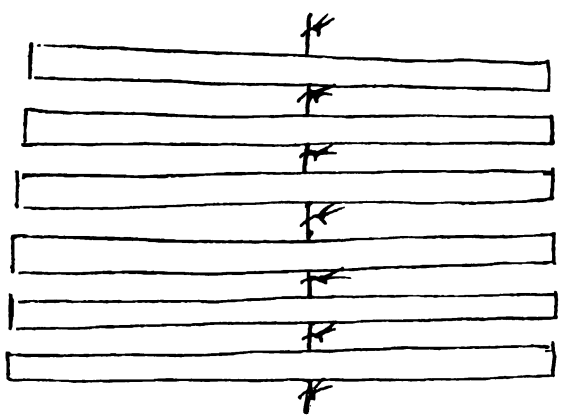


FIG. 2.—Strips of adhesive plaster applied between interrupted sutures.

urated with extract of witch hazel, the swelling and discoloration will rapidly disappear.

For the more severe forms of local injury, as wrenches or sprains or even the lameness which comes from unusual and severe muscular efforts, I have found the following to give excellent service:

℞. Tr. Arnica Mont.,
Tr. Bryonia alb.,
Tr. Hypericum perf., aa ℥ss.
Glycerine, ℥j.
Alcohol, q. s. ad ℥vj.
M.

Apply on compress or rub in well with the hand. This will give relief from the local soreness and inflammation.

A sprained ankle should be given rest and treated in the usual method of strapping or even with the plaster of Paris cast if the sprain is very severe.

As a rule, however, I do not find it necessary to confine a patient with a sprained ankle, but either with or without the strapping, a brace is made which is attached firmly to the sole of the shoe at the arch. Steel bars run up on either side of the leg to a band well up on the calf. There is no joint at the ankle, and the patient may walk about without motion at the ankle joint; and although the gait is awkward, it is comparatively free from pain, and the treatment is much more satisfactory than when the patient is obliged to depend on crutches to get about.

Fractures and dislocations being common to all ages do not necessarily come within the scope of this work.

BURNS.

Children are especially liable to injuries by coming in contact with hot stoves, scalding fluids or from their clothing catching fire; and disfiguring scars from burns received in childhood are not uncommon sights. The gravity of a burn depends on its location, its extent, and its depth. A burn on the face may be disfiguring; a deep burn in the region of the neck or about large joints may result in distorting contractures. Burns over the abdomen or covering large areas, are followed by profound constitutional symptoms, as hæmorrhages, albuminuria, dysentery, cerebral congestion, if they are not fatal. Burns are divided into three classes:

First. Where there is only an erythema, the skin being only reddened without vesication.

Second. Where the epidermis is raised by large collections of serum, in blisters without deeper injury; and,

Third. Where the tissues are deeply charred or baked so that their function is lost. Burns of this last class are followed by sloughing of the injured tissues, and healing is slow and tedious, and unless prevented by plastic operation, will result in cicatricial contractions. Extensive burns though light in degree, may be more fatal than deeper burns involving less surface. It is claimed that superficial burns involving one-half of the surface are fatal.

Children are especially susceptible to shock from burns, and may require very careful treatment in the first stage after the receipt of the injury.

The treatment depends on the extent and depth of the burn and the condition of the patient.

The latter may require, first, attention to combat the results of shock, and it may be necessary to apply heat to the unburned parts, and even place the patient in a warm bath if he has a chill. Stimulants may be required.

For relief of pain in small burns frequent applications of saturated solution of bicarbonate of soda or 1:8 solution of phenol sodique are excellent.

Where the condition is more serious and the clothing sticks to the injured part, it should be cut away, and every care taken to avoid infection. Even an anæsthetic may be required for the dressing. A spray or solution of peroxide of hydrogen will facilitate the removal of charred and dead material.

If the parts are rendered aseptic they may be covered with sheets or strips of sterilized gutta percha tissue, which will keep out the air, prevent drying, and can be easily removed.

Over this, layers of sterile or antiseptic gauze should be applied. Iodoform gauze works well here.

Large blisters should be cut, close to the skin. The fluid carefully pressed out, and the epidermis allowed to collapse.

Senn's powder, i. e., boric acid, three parts; salicylic acid, one part, may be dusted over the surface. If the wound is not too extensive the following solution on compresses allays pain and hastens healing:

℞.	Picric acid,	ʒiss
	Alcohol,	℥ij.
	Dissolve and add	
	Olive oil, sterilized (by heat),	℥xxxij.

This preparation of picric acid is preferable to the watery solution, as it will not dry out or stick to the tissues. On the other hand, care should be employed in the use of picric acid on too large surfaces for fear of toxic effects. There are many other preparations advocated which may be of use, but in case of emergency, and where the materials recommended can not be obtained, common sense must prevail, and I should say, use what is at hand, bearing in mind that the indications are: 1st. to obtain and maintain asepsis; 2d. to relieve pain; 3d. protect the parts from the air and possible infection, and 4th. to hasten healing by every means possible.

Of course, resulting constitutional complications must be combated, for, as Da Costa states (Modern Surgery, Da Costa): "The blood of burned animals contains toxins (kijanitzen) and so does the urine (Reir). It seems probable that the constitutional symptoms and death, if it occurs, are due partly to corpuscular disorganization and partly to absorption of toxic matter from the seat of injury, this matter having been formed by the action of heat on the body cells and fluids. Sepsis is not infrequent. Death may be directly

due to shock, to sepsis, to exhaustion, to embolism, or thrombosis, to congestion of the brain, lungs or kidneys, or to Curling's ulcer of the duodenum."

The continuous warm bath as recommended by Fauntleroy (Am. Jour. Med. Science, June, 1905) has many advantages of relieving shock and ease with which attention may be given to the burned surfaces. He also advises after the sloughs

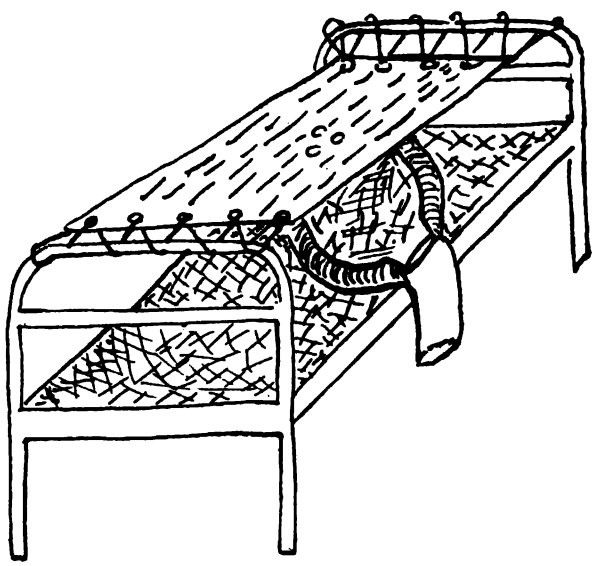


FIG. 3.—Bed for bad burn cases. (Abstract Practical Medicine Series, Vol. II., 1906.)

begin to separate, the use of continuous antiseptic irrigation with aluminum acetate, and "to avoid the sinking in of the mattress and accumulation of the fluid under the patient . . . a piece of canvas is lashed from the head-piece to the foot-piece. Some small holes in the center allow the fluid to drain off. A fenestrated tube is incorporated in the compresses over the wound and secured by a few turns of a roller bandage, and, after passing through a small hole in a blanket, com-

municates by means of a short glass tube with the tubing from an irrigator. . . . In this way the dressing is kept moist."

H. Sneve (Jour. Am. Med. Association, July 1, 1905) recommends the open treatment for burns, claiming that a much better cicatrix is obtained.

Several years ago a man who had been badly burned on the trunk, and arm, and who had been in the Hahnemann Hospital for several months without healing, came into my service, and it was not until I tried the open treatment that I could get any result. Under this method cicatrization progressed rapidly.

Some extensive slow healing cases require skin grafting. In fact, it should be done in any case where there is difficulty of healing, or danger from contraction of the cicatrix.

Directions for this operation have been given in the chapter on skin grafting. In one case of an extensive burn on the abdomen of a child, where Thiersch's grafts refused to take, I applied the skin from the bellies of six large frogs with the result that healing was complete in a very short time.

SKIN GRAFTING.

Skin grafting may be required in children to repair the results of accidents or disease. Burns frequently leave large raw surfaces, which either refuse to heal, or which, if allowed to cicatrize, result in deformity or distortion. Where raw surfaces are the immediate result of an aseptic operation it is better to graft immediately than to wait for a secondary operation.

Every granulating surface is more or less septic if not infected. That is, a certain amount of necrosis is going on in the superficial layers which may be sufficient to prevent large

grafts "taking" because they would be simply floated off by the accumulation of fluid underneath them.

For this reason, if practicable, a freshly cut, clean surface is much more suitable for grafting than one in which granulations have developed. In such cases all that is necessary is to stop all oozing and apply the grafts immediately.

A granulating surface, however, must be properly prepared beforehand, and I believe there is no better method than the one which I described in an article on "Skin Grafting Infected Areas." (Annals of Surgery, May, 1904.)

The method is essentially as follows: The granulating surface should be prepared by applying a compress wet with a one

FIG. 4.—McBurney's rake.

per cent. solution of formaldehyde (using the regular 40 per cent. preparation as the unit) for twenty-four hours before the operation. Over the compress is laid a piece of gutta percha tissue to retain the moisture. This compress is left in place until the patient comes to the operating table. When the dressing is removed it will be found that the superficial layers are dry and brownish red, resembling in color and consistency dried smoked beef. This layer can be scraped off with scarcely any bleeding, and the layer underneath will be found pinkish in color with only a few bleeding points. All the oozing should be stopped by the application of a Martin's pure rubber band for a few minutes, with moderate tightness.

The smooth rubber possesses the advantage of not only stopping the oozing by its pressure but it does not stick to the tissues when it is removed, as is the case when the pressure is made with gauze.

Thiersch's grafts are taken in the usual way from the anterior portion of the thigh by preference. The skin having been prepared and rendered aseptic, is put on the stretch with McBurney's rakes or wide, sharp-pointed retractors. Then, while saline solution is kept dropping on the part, the thinnest possible layer of epidermis is removed with a razor. As the razor separates the thin layer it piles up on the blade in folds and may be drawn off with forceps and spread over the surface to be covered. After covering the whole denuded area

FIG. 5.—Cutting Thiersch's graft. (Redrawn from Fowler's Surgery.)

with the grafts, they are pressed down on to the raw surface carefully so as to secure an accurate approximation. Then they are overlaid with strips of rubber tissue about three-fourths of an inch in width. These are clap-boarded on so that each one overlaps the preceding one about one-third of an inch. Placing these strips in this way allows any serous discharge to pass out easily between them into the dressings. Firm, careful pressure is made to express any fluid which may have accumulated, and the dressings applied. I usually put on a few thicknesses of gauze wet in saline solution, or a layer of

iodoform gauze, preferably the former. Over this is placed several thicknesses of gauze wrung out of $^1/_{2000}$ bichloride of mercury solution.

The object of this antiseptic solution is that nothing of a septic nature shall be allowed to get to the wound, and also that any discharge from the wound may be rendered innocuous.

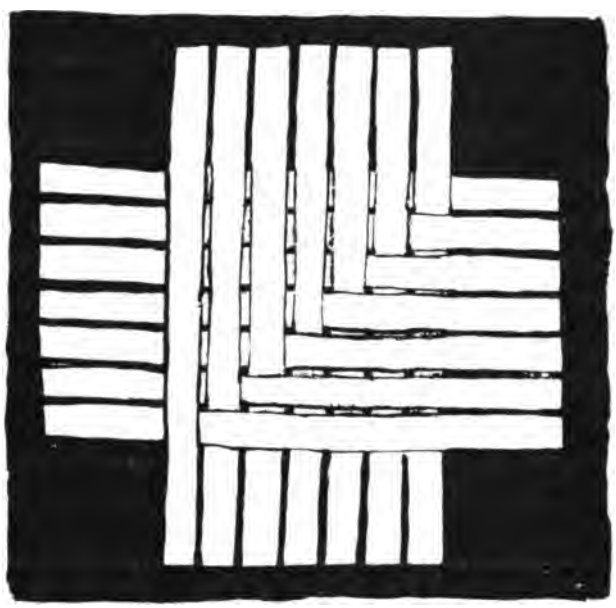


FIG. 6.—A method of applying rubber tissue strips. (Redrawn from Fowler's Surgery.)

The iodoform gauze is excellent for this purpose. The gauze dressings may be changed in two or three days, and as often afterwards as may be deemed necessary, but the rubber strips should be left on for a week or ten days longer.

The rubber tissue obviates the necessity of freqently wetting the dressings to prevent keloid, and, as it does not stick to the grafts it can be removed without disturbing them. After ten days or two weeks the grafts will be found firmly adherent, and a dry protective dressing only need be kept on for a while

longer. In the majority of cases the grafts adhere directly to and grow on the underlying tissues. Later on, the external layer of epidermis exfoliates leaving a smooth layer of skin underneath, although it is claimed by some writers that several months elapse before this takes on all the characteristics of true skin.

In some cases the grafts seem to soften and disappear, and one is inclined to think the operation has been a failure. But within a few days the wound becomes covered with a layer of epidermis. It is thought that certain cell producing elements of the grafts have been taken up by the granulations and are used as seed (food) for the production of new skin. The method as described above has been employed by the writer in treatment of old varicose ulcers with good results. I have also used the thin skin from the bellies of frogs for application to a large unhealed burn on the abdomen of a child, with good results.

In another case where a boy had been partly scalped in a street car accident and the skull was bare, I slid a flap sideways over the bare bone, and on to the raw place from which the flap was taken I grafted the skin of a dog. The result was apparently good, although the child left the hospital and the city before final result was known.

In some cases, it is of advantage to transfer good sized pieces of skin of full thickness from one part to another. Under perfectly aseptic conditions this method is quite feasible.

The place from which the grafts are taken should be covered with a sheet of sterilized gutta percha tissue slightly larger than the denuded surface. Over this an antiseptic compress should be bound. This may be allowed to remain *in situ* for several days, at the end of which time epidermization will have taken place.

In some cases where it may not be advisable to use the large grafts, Reverdins's method may be employed. This consists of taking small bits of skin from one place and implanting them on a granulating surface.

I have also used successfully very thin sections taken from the sole of the foot. It is hardly necessary to emphasize that the foot should be most carefully sterilized.

LOOSE NEEDLES IN THE FLESH.

While children are not so likely to have broken needles in the flesh as adults, still it does occur. It is seldom that a whole needle passes under the skin. Usually it is broken off and a portion, with the blunt broken end outward, enters the tissues under the skin. As the limb containing it is moved, the muscular action is exerted against the blunt end forcing the sharp point through the soft tissues or between the muscles and tendons, and in this way the needle may travel for long distances and remain for years in the body. Well authenticated cases have been reported of broken needles finding a final lodgment in the heart muscle and causing death.

Usually after the accident there is sharp pain at the location of the needle, and a small point is found on the skin showing the place where the needle has entered. Sometimes there is local pain and swelling. When such an accident has occurred the surgeon should locate the needle by the X-ray. As a rule, this is usually accomplished with ease, but occasionally where the fragment lies close alongside a bone and at bad angle for operation of the X-ray, some difficulty may be experienced.

In operating for removal of the needle it is always better to make a U shaped incision, turning back a flap of the skin and

underlying fat and fascia. As a rule, the blunt end of the needle will be seen sticking up out of the flesh.

Attempts to get the needle through a straight incision are likely to meet with failure on account of the great probability of going to one side of the fragment.

KELOID.

Keloid, the growth which occurs frequently in scar tissue, while not so often found in children, is sometimes a result of of vaccination. The scar is large, red and raised above the surrounding skin. If removed with the knife, it has a persistent tendency to return, although no reason for its doing so has yet been ascertained. Thus far, I have had the best results in diminishing the growth by the use of the high frequency current and fulguration with an occasional application of a mild X-ray treatment.

NAEVUS.

Naevus is an enlargement of the capillaries, and may consist of only venous elements, or of both venous and arterial. They form a close network under the skin involving its deeper layers. The vessels become enlarged and tortuous, and are held together by a mesh of areolar tissue.

A naevus appears as a bluish or reddish patch, sometimes forming a tumor which is raised above the skin, and becomes larger when the child cries. If there is a large proportion of arterial elements in the tumor, it may be felt to throb with the beating of the heart. Pressure will diminish the tumor, but it

immediately returns to its original size as soon as the pressure is removed. It is congenital in origin, but frequently at birth it

FIG. 7.—Large naevus on brow of a baby, excised by the author and wound covered by Thiersch's graft.

appears only as a small spot, sometimes not more than a mere dot, but it may grow with great rapidity. Naevi are not always

subcutaneous, but may be formed in the orbit, liver and other viscera.

When it occurs on the face it causes more or less disfigurement according to its size and location, but gives rise to no discomfort unless it ulcerates or is broken, when troublesome hæmorrhage may ensue.

Various methods of operating on naevi have been employed most of which are now obsolete. Nearly all of the old methods arose from the fear of hæmorrhage, and consisted in such measures as ligation, the use of setons or caustics, electro-puncture, or the injection of coagulating fluids. I have employed, or seen employed, most of these measures, and believe that in nearly all cases they are unsurgical, because they induce prolonged suppuration, and the wound has to heal slowly by granulation. I have had electro-puncture used in a number of cases, and in every one suppuration and delayed healing followed. Fulguration may be of use in very minute naevi.

If possible, the best, quickest and cleanest way to cure a naevus is to cut it out, making the incision outside the affected area, tying the vessels leading to it, and, if feasible, stitching up the edges of the wound. Where it has happened that coaptation of the flaps could not be done, I have skin grafted immediately with perfect results.

Ligation may be required in some cases, and the best way is to take a curved needle armed with a stout double thread. Pass the needle underneath the middle of the naevus, cut it loose from the thread and tie the two parts of the thread each around one-half of the tumor. It is better to incise the skin around the edge of the naevus before tightening the thread, allowing the ligature to rest in the groove. This saves time in cutting out, and is also much less painful, as pressure on the sensitive cutaneous nerves is avoided.

WARTS.

Warts are of frequent occurrence on the hands of children, they also sometimes are found on the face, especially on the upper lip, and are quite disfiguring. It is now conceded by the latest authorities that warts are contagious, although of slow incubation. In children there is small likelihood of their being syphilitic or malignant. Just why they appear and disappear, as they do, is not known.

With children the simplest methods of treatment are the best, and the more radical methods should be reserved until the milder ones have been exhausted.

Among these are the application of glacial acetic acid, tincture of thuja oc., or of pure alcohol frequently applied. The action of these applications is hastened by first scraping or sand-papering the horny top layers away and making the application to the softer tissues underneath.

The application of the spark from the high frequency electrode or fulguration is of value. The application of pure nitric acid is efficacious, but it is painful, and will be followed by a scar.

MOLES.

The ordinary pigmented moles, which occur on the skin, may be made to disappear by the application of the high frequency spark or fulguration, and if care is used no scar will follow.

SARCOMA.

While carcinoma is very seldom seen in children, cases of sarcoma occur with greater or less frequency. I have seen several, among which was one case of sarcoma of the femur in a child less than two years of age, seen with the late Dr. Robert McMurray. A case of sarcoma of the upper jaw in a girl seven years of age was brought to me by Dr. Sarah C. Silver-White, which I removed successfully in the usual manner by resection of the left superior maxillary bone.

FIG. 8.—Author's case of sarcoma of the upper jaw in a child of seven years. The scar on the cheek indicates point where a small portion of tissue was removed for microscopical examination.

On one occasion I made a post-mortem examination of the body of a young girl of thirteen years of age who had died of a large sarcoma of the ovary. The tumor may manifest itself by its persistent growth, but need not necessarily give much discomfort until by its invasion it affects surrounding parts, which it may crowd out or destroy.

Later on its tendency to break down, the foul discharge and systemic infection destroys the patient's life.

In case a sarcoma is diagnosed, the only thing to do is to remove it as quickly and thoroughly as possible. If it occurs in a limb, as a rule, nothing short of amputation at or above the next joint will be of any use. In case it occurs in other parts, the area of operation should include tissue clear outside of the growth, even though the wound has to heal by granulation. In fact, it is claimed that when such is the case the result is better. It would not be right to attempt other methods in a clearly defined case, as valuable time would thereby be lost. The method of treatment by injection of erysipelas toxins with bacillus prodigiosus (Coley) would not be right in the case of a child. It is too painful and too uncertain in its results. I have obtained one cure in a case of lympho-sarcoma of the forearm following fracture in an adult, but in a number of other cases in which I have tried this method, it has failed to benefit.

At the best the prognosis is doubtful, but as in all desperate cases, the patient should be given the benefit of any remedy, no matter how desperate. I certainly should not waste time with the X-ray or any other form of electrical or local treatment.

ANÆSTHESIA.

BY J. WYLLYS HASSLER, M. D.

The proper anæsthetic for children can only be determined after a careful examination of the case, and when the nature and length of the operation have been made definite. Chloroform is usually the anæsthetic of election, and I think unadvisedly so. This is due to the fact that ether may produce bronchial and pulmonary conditions in the infant and young children, the mucous membrane of the respiratory tract being delicate. Another reason is, children bear chloroform well.

Chloroform undeniably produces very good results if properly administered, but we must keep in mind that deaths from it occur as frequently in childhood as in adult life, and the possibility of an untoward result is as great with children as with the adult. I have found that a child approached in the proper manner, thereby gaining its confidence, will allow ether, nitrous oxide or nitrous oxide and ether to be administered. Children naturally resent having the face covered by a mask, but that should not contraindicate the giving of ether or the combination with gas. The trend of opinion among anæsthetists at the present time favors the giving of ether to children when it is not contraindicated. In the first place, they yield readily to its influence; secondly, they require but a small amount to acquire and maintain ether narcosis, and thirdly, when anæsthesia is once accomplished it can be maintained for a longer period after the mask is removed than when under the influence of chloroform. This fact is of particular advantage in mouth and throat operations. In operations where the reflexes are disturbed and their consequent influence upon respiration induces deeper inhalations, with the fact that

chloroform, being four times heavier than air, is carried to the residual air spaces, often causes alarming conditions. The mistake is often made of giving more of the anæsthetic than is necessary to maintain anæsthesia. The patient being soaked with the anæsthetic, gives the severe shock symptoms with chloroform, and the bronchial and pulmonary conditions with ether.

The A. C. E. mixture; alcohol, chloroform and ether, in the proportions of 1, 2, 3, is advised where we find that either ether or chloroform cannot be given. It is sometimes given as a primary anæsthetic to chloroform.

If chloroform is the chosen anæsthetic, I find the Northrop method of combining chloroform and oxygen will give the best results. By this method seldom more than one to two drams for the hour is needed in children. In long operations, by the addition of oxygen, we add a certain element of safety. It is particularly applicable to head, mouth and throat work, a soft rubber catheter being introduced through the nares. By this method the anæsthetist is out of the way of the operator, and no face piece is necessary. In mouth operation with excessive bleeding, the catheter is carried well into the post-pharynx, a drain of cotton is placed anterior, preventing the blood from being inhaled or swallowed. This method is also applicable with the modified Hewitt mouth-gag. The chloroform and oxygen passing through the hollow gag fills the buccal cavity. By this means the anæsthetist also allows the operator a free field. The apparatus consists of a small tank of compressed oxygen, tank connection; rubber tube connecting tank to a metal inflow tube, which passes through a tightly fitting rubber cork to the bottom of a three ounce bottle containing one ounce of chloroform; an outflow tube fitted to just inside the cork, to which is connected a second

rubber tube connected to a metal face piece having a rubber reservoir air bag. The oxygen flows up through the chloroform, mixing the gas with chloroform fumes. The strength of chloroform desired is controlled by the rapidity and force of oxygen liberated. There can also be an extra tube attached by a two-way stop cock to the tube from the oxygen tank. In this way the patient can be given oxygen alone if desired. If chloroform is given by the open method the Esmarch inhaler is advised.

In giving ether, the preferable method is the nitrous oxide gas and ether sequence. Children will accept gas on account of its lack of odor. Though at first they may show a disposition of fear at the sight of the instrument, once they learn there is freedom from a disagreeable odor they will relax and take the gas. The stages of anæsthesia with gas are very short. Often in a few seconds anæsthesia is complete, and then maintained by releasing the ether. By this method but a small amount of ether is used in an hour. With the author's instruments as small an amount as one ounce for the hour has been all that has been necessary. If the open method of ether anæsthesia is desired I again prefer the use of the Esmarch inhaler in children. At times a small piece of gauze, five or six thicknesses, will act very well as a carrier.

The Allis inhaler is also a very excellent means of administration. In the open method, no matter which of the above means are used as the inhaler, the drop method of ether administration should be adhered to. Ether by means of rectal anæsthesia has been advised, even in children, though our reports of cases among children are very limited. It is applicable to operations about the head and neck. It is claimed that less ether is required, recovery is very rapid and the after effects are less severe. Its disadvantages are the length of time to

complete anæsthesia, the possibility of causing meteorism and diarrhœa, and if given too freely leads to great suffering and danger. It is contraindicated in cases with a past or present history of intestinal catarrh or dysenteric attacks.

Great care must be taken that no liquid ether enters the rectum. The time varies as to the production of anæsthesia, but, as a rule, children are influenced readily.

To assure rapid anæsthesia, it is advisable to induce primary anæsthesia by the inhalation method, following this by rectal anæsthesia. The apparatus suggested by Cunningham, of Boston, improved and demonstrated by Leggett, of New York, is advised. The apparatus consists of two cylinders: an outer cylinder containing water, just below 37° C., a smaller inner cylinder in which two or more ounces of ether is placed. Attached to the ether bottle are two tubes, one extending to the bottom of the bottle, to which is connected a rubber tube with a hand bulb, for pumping in air. A second tube just inside the cork acting as the outflow, is connected to a rubber tube to which is attached the rectal piece.

In children the usual rules are followed in preparing a case for anæsthesia; the food four hours before anæsthesia, and means to prevent shock, possibly being the more important. I believe cathartics should be omitted, as frequent stools produce an irritable patient and add to the possibility of shock. Avoid having the child see anything that will cause fright. I witnessed a death following fright, and excessive resistance in a child ten years of age: she had inhaled less than a half dram of ether given by the drop method, when she collapsed. Sequestration anæmia, as suggested by R. H. M. Dawbarn, of New York, for the prevention of shock and lessening the amount of the anæsthetic to be given, is of extreme value.

The principle is the accumulation of blood in the extremi-

ties, preferably the lower. The technique is as follows: "Before the operation a towel folded lengthwise is wrapped about each thigh very close to the trunk, and upon this a rubber tube is tightened. The degree of tightness is quickly learned by practice. It must nearly stop the venous but not the arterial current. The limb distal to the tourniquet grows dusky in color, and there is obvious swelling. The congested limbs are warmly wrapped and hot water bags placed about them.

The advantages claimed for this procedure are:

I. Diminution in amount of anæsthetic needed.

II. Ease of control of hæmorrhage during operation, because of lessened intra-vascular pressure.

III. A shortened operation, because of a dryer field.

Dr. Dawbarn has demonstrated other conclusions of value, but the above pertain particularly to anæsthesia.

There are certain contra-indications: (a) Change in the blood; (b) change in the vessel wall, and (c) changes in speed of current. If shock symptoms present during operation, gradually release one or both tourniquets, giving the heart time to accommodate itself to the added amount of blood.

The blood thus released is free of the anæsthetic, the patient reacts quickly, and no vomiting occurs. The youngest patient recorded was eighteen years, still I believe this method is applicable to children. In the limited number of cases that I have seen, I am very much impressed with the importance of sequestration anæmia. To overcome shock, if present, heat to the surface of the body and perfect rest will, in the great majority of cases, be all that is required. If stimulation is called for, adrenalin, five drops subcutaneously, has given me good results. The only disadvantage to adrenalin is that the effect is not long lasting. A stimulant that possesses all the good features of adrenalin and at the same time has a long

lasting effect, and which, therefore, I believe to be superior, is the extract from the pituitary gland. The dose in the adult is 1 c.c. to 3 c.c., subcutaneously. This dose can be readily repeated if necessary. In cases of collapse, following severe hæmorrhage, saline solution is at once called for, either as a rectal douche, hypodermoclysis, or intra-venously, according to the urgency of the case. The pituitary extract or adrenalin can be added to the salt solution. Strychnia is of value in the respiratory depressions, also in the mild forms of shock.

The complication most frequently present during the administration of an anæsthetic and due to the anæsthetic, is respiratory failure. In these cases artificial respiration by the appropriate method must be practiced. In young children with easily compressible ribs the lateral decubitus and rapid alternate compression with the hands grasping the ribs and then liberating them is most successful. In children who are large and strong one of the three following methods are called for: If fluid is in the lungs the Marshall Hall plan should be adopted, in other cases Sylvester's or Howard's method.

A post-operative complication that has caused a great many unnecessary deaths, is so-called ether pneumonia. I believe most cases are due to a lack of proper protection to the body of the child when moved from the operating room and table to a cold room and bed. Another frequent cause of these pneumonias is the inhalation of infected mucus, giving us our inspiration pneumonia. The mouth and throat should be kept clear of mucus during anæsthesia. Local anæsthetics are inadvisable to very young children; they cannot be controlled, and, therefore, the operation is interfered with. I believe to safeguard the child a general anæsthetic is always called for.

HYDROCEPHALUS.

In hydrocephalus there is a pathological increase of cerebro-spinal fluid within the cranium. It may be acute or chronic. There are two varieties, the internal and external. The internal variety is where the fluid distends the ventricles, while in the external it collects either between the dura and pia or in the spaces of the pia.

The internal variety is of the most interest to the surgeon, and is accompanied with enlargement of the upper part of the head. The quantity of fluid may reach an enormous amount, even up to fifteen quarts. The fontanelles become prominent during the act of crying, while in marked cases the cranial bones become much thinned and widely separated. The frontal bone is tilted forward, giving a peculiar appearance to the eyes, in which the upper part of the cornea and a portion of the sclerotic are exposed, while the lower portion of the cornea is covered by the lower lid. The auditory meatus may point downwards. The face is small and narrow in comparison with the upper part of the head. The enlargement of the head may be so great that the child is not able to hold it up, and it has to be supported. The scalp is sparsely covered with hair and the veins are prominent. The intellect is usually weak, but not in all cases. The child often does not walk or talk; convulsions, palsies, contractures and blindness may be present. A very prominent symptom is nystagmus or irregular strabismus. In some congenital cases the head is so much enlarged as to seriously impede delivery, and cases of rupture have occurred during parturition.

Da Costa (Modern Surgery) mentions the following as causes: "Chronic internal hydrocephalus is usually congenital, but may arise after birth in children under seven.

"In congenital hydrocephalus the condition may be due to circulatory disturbance in the brain of the embryo resulting from internal disease or injury during pregnancy."

Syphilis or alcoholism in the parents are assigned as causes, also tuberculosis and rachitis. "Acute hydrocephalus occurs

FIG. 9.—Chronic hydrocephalus of average severity; head of pyramidal shape; showing characteristic expression of the eyes. (Holt.)

most frequently in connection with basilar tuberculous meningitis. Chronic acquired hydrocephalus as contrasted with congenital hydrocephalus is not a distinct disease but is the result of different inter-cranial diseases, such as acute serous and possibly tuberculous meningitis, or it may develop as a chronic process from the beginning. Cases of the first class with acute

onset, occur about the end of the first or second year. Those of the second have a varied etiology. In this category must also be placed cases of serous effusion into the ventricles, in rhachitic, perhaps also in syphilitic children. Cases of chronic hydrocephalus following encephaloceles, and spina bifida, the accumulation of cerebro-spinal fluid in one ventricle after inflammatory closure of the channel of communication with the other cavities containing cerebro-spinal fluid, the filling large porocephalic clefts with fluid, the same condition in other cases of loss of substance produced by traumatism or atrophy, and the dilatation of the ventricles in connection with cerebral tumors.

"If chronic hydrocephalus develops before closure of the sutures and fontanelles, it produces the same increase in size and shape of the skull that is characteristic of typical congenital hydrocephalus. If it occurs later, when the skull has become firmly and rigidly closed, it exists without increase in size. In fact, even cases of microcephalus have been recently reported in which the ventricles were dilated and filled with fluid. (Von Bergmann-Bull, Vol. I.)

The diagnosis is, as a rule, not difficult. V. Bergmann says: "In diagnosing between acquired hydrocephalus with enlargement of the skull, the time of increase in the size of the skull and development of hydrocephalus, after previous acute inter-cranial inflammation, must be taken into consideration."

The prognosis in chronic hydrocephalus is not encouraging. Medicine has little to offer, and the condition is more a surgical one. Although the result for a large percentage of cures has not yet been obtained, still as there is a certain proportion of good results, and except for the fact that an occasional spontaneous recovery has occurred, the expectation of a favorable termination without surgical interference is hopeless,

the persistence in attempts to relieve chronic cases by operation seems to be called for.

In mild cases certain conservative measures may be attempted. Strapping of the head to prevent its expansion may be tried. This must be done with great care to avoid sloughing, and elastic pressure is safer than inelastic strapping. Exposure of the child's head to the sun's rays is said to be beneficial. I have used the high frequency electrical current with good result in one case of congenital hydrocephalus in a child six months old. The applications were made every other day, and a strong enough current to cause a bright reddening of the scalp was used for ten or fifteen minutes each time. Under this treatment the extreme disproportion between the head and the face rapidly diminished, and the child became normal in other respects. Dentition occurred without trouble.

In Von Bergmann's-(Bull) work are described four methods of operating.

"I. Lumbar puncture; II. ventricular puncture; III. drainage of the ventricles; IV. drainage of the spinal dural sac."

In the first the puncture is made "in the median line behind, at a point where the latter would be intersected by a horizontal line passing through the crest of each ilium." This operation would be useless where the passage from the brain to the spinal cord was occluded.

In the second, an incision is made "a little above and at the inner side of the tuberosity of the frontal bone. The bone is trephined and a hollow needle passed backward and a little downward and inward through the brain tissue until the fluid flows."

Established drainage of the ventricles and spinal cord are dangerous on account of danger of infection, according to the author just quoted.

Brewer (Text Book of Surgery—Brewer) reports operating on three cases by establishing drainage of the ventricular cavity through the tentorial surface of the occipital lobe, by means of folded rubber tissue drains. The wound in the bone was closed. One patient lived six weeks with marked improvement, while the others died from the operation.

Alfred S. Taylor (Am. Jour. Med. Sciences, August, 1904) has operated on six cases with two perfect recoveries, by introducing a drain made up of six strands of forty day catgut, No. 2. These are wrapped with three layers of catgut membrane and introduced into the lateral ventricle through the second temporo-sphenoidal convolution. The dura and skin are then sutured and the fluid drains off slowly under the scalp.

CEPHALOCELE AND SPINA-BIFIDA.

In some cases the bones of the skull or vertebræ fail to develop completely during fœtal life, and through the gaps in the bone, protrusion of their contents may be found at birth.

Von Bergmann (v. Bergmann-Bull, Vol. I) places all herniæ of the brain under the general heading of cephalocele. He says that it occurs once in about 3,500 to 4,000 cases, and is always found in certain definite situations in the skull on the median line, either in the occipital region or in the region of the glabella at the root of the nose. Rare forms occurring at the base of the skull emerging through a cleft between the sphenoid and ethmoid bones and projecting into the nasal cavity have been mistaken for naso-pharyngeal polypi, and have been operated on with fatal result.

Occipital cephalocele is either *superior* or *inferior,* according as it emerges above or below the external occipital pro-

tuberance. If above, it may communicate with the posterior fontanelle: if below, with the foramen magnum, and possibly through defects in the upper cervical vertebræ.

If a frontal cephalocele emerges above the nasal bones in the region of the glabella it is *naso-frontal;* if at the inner angle of the eye it is *naso-orbital,* or if below one of the nasal bones it is *naso-ethmoidal.* Most writers divide these herniæ of the brain into three varieties, *i. e.,* 1. *meningocele,* where there is simply a projection of the meninges containing fluid; 2. *encephalocele,* where a portion of the brain substance occupies the sac, and 3, *hydrencephalocele,* where the meningeal sac is lined with a layer of brain substance containing cerebro-spinal fluid and the cavity of which is direct connection with the lateral ventricles.

Most writers give methods of differential diagnosis between these varieties, as:

Meningocele is usually cystic, translucent, fluctuates, rarely pulsates, more or less pedunculated, tense on forced respiration, easily reducible. The least frequent variety.

Encephalocele is usually small, opaque, pulsates, sesile, more tense during forced expiration, and symptoms of pressure are produced on attempts at reduction.

Hydrencephalocele is generally large, lobulated, partly translucent, fluctuates, pulsates rarely, usually pedunculated, slightly tense on forced expiration, not reducible. This is the most frequent and most fatal variety.

In all varieties the overlying skin may be tense and dead white, or loose and wrinkled. Scars and ulcers on the surface are common. The summit may be bare and the base hairy. It is often difficult to feel the edge of the bone.

All are congenital. All are often accompanied by other deformities, and paralysis often accompanies hydrencephalocele.

According to von Bergmann's theory, however, nearly all varieties are originally hydrencephaloceles connected with the lateral ventricles, but which may have undergone change in shape or character, and what is supposed to be only a meningocele may contain a layer of brain substance so attenuated as to be recognizable only with the microscope. The amount of brain substance in a tumor may be determined by passing a strong light through it. The brain substance shows darker shadows or streaks against the clear pinkish ground.

FIG. 10.—Meningocele. (McNutt in Keating's Cyclopædia of Diseases of Children.)

A diagnosis in the case of a newborn child must be made between cephalocele and caput succedaneum, nævus and abscess.

Operatives measures for the relief of cephalocele have been devised, and some cases of recovery after operation have been reported. As a rule, attempts at reduction of the hernia are ineffectual because the skull is too small to contain the portion outside of it. The prognosis of an operation depends largely on the amount of brain substance contained in the tumor. In a meningocele or in a very thin walled hydrencephalocele

where there is only a very small amount of expanded brain substance a good result may be hoped for from operation. The operation consists in splitting the scalp over the tumor and turning it back on each side to the base of the tumor. This may then be clamped with long bladed forceps and the sac removed a short distance from the blades of the forceps. It may be necessary to aspirate the fluid before this can be accomplished. Then the edges of the membranes are whipped together with a closely stitched running suture. The scalp flaps are then trimmed and reunited. The child should be held in an upright position during the operation.

A. Q. Silcock (Lancet, March 26, 1904) reports a cure of hernia cerebri by removal with knife and cautery and placing a lead plate over the opening in the skull.' In any portion of the spinal column similar lack of development with protrusion of its contents may occur, but the most frequent site is in the lumbar region.

According to their formation spina bifida are defined by Brewer (Brewer's Surgery).

"Meningocele is a hernia of the spinal membrane forming cystic protrusion, covered with epidermis."

"Meningomyelocele is a meningocele having the flattened spinal cord on its posterior wall. The commonest variety."

"Syringomyelocele is where the meninges are defective, and the protruding cyst is composed of tissues of the cord dilated by a collection of fluid in the closed central canal. Very rare."

"Myelocele is an imperfect union of the medullary folds. The central canal is open and the medullary folds spread out on either side and continuous with the skin. The medullary portion is of a bright red color and highly vascular. Children with myeolocele die in a few days after birth from constant leakage of cerebro-spinal fluid."

Where the conditions in spina bifida are similar to those in cephalocele which are operable, it may be treated on the same lines. Possibly on account of the less risk more radical measures may be tried in spinal hernia than would be justifiable in

FIG. 11.—Spina bifida. Lumbar region.

hernia of the brain. An old method has been the injection of Morton's fluid into the sac.

℞.	Iodine	grs. x.
	Kali iodide	grs. xxx.
	Glycerine	℥j.

Leonard Freeman (Jour. Am. Med. Assn., March 22, 1902) reports a successful operation on a case of meningomyeolocele by opening or draining the sac, then darning across the opening with silver wire, which holds the plug of reduced membrane and new tissue in position until healing has taken place.

Murphy (Practical Medicine Series, 1906, Vol. II) reports improvement of development in a case of a three-year-old patient with meningomyeolocele (below the eleventh rib.) When "the tumor was removed the laminæ were united and the cord sutured end to end."

If operation is not possible the only thing to do is to protect the sac from injury and rupture. A small wire cage, fitted to a broad belt and filled with cotton so as to make pressure and at the same time ward off blows, will be of service.

In an operation recently performed by Dr. Wm. Tod Helmuth, the overlying skin and superficial structures are divided transversely down to the sac. The sac is dissected clear from the surrounding structures and then opened in a longitudinal direction, and the protruding nerve tissue tucked back into the canal. A few sutures passed from side to side of the sac prevent prolapse. Then dissecting up the longissimius dorsi muscle on one side, a pair of long bladed forceps is passed underneath it. The redundant portion of the sac is caught in the forceps and pulled through and fastened to the outer edge of the muscle. Then the two muscles from the opposite sides are drawn together in the median line and united by sutures in such a manner that they make pressure directly over the aperture in the bone, and upon the collapsed sac. The skin is closed by a few sutures.

EPILEPSY SURGICALLY CONSIDERED.

"Epilepsy is but a symptom just as cough or fever." (Landon Carter Gray, Keating's Encyclopædia of Diseases of Children, Vol. IV, p. 900.)

In surgery the significance of the group of symptoms comprising what is known as epilepsy is often important, for they may have for their origin some pathological condition which may be relieved by surgical interference.

The cause may be local and consist in a thickening of the skull at the site of an old injury. The increase in thickness may be callus thrown out at the site of a fracture without displacement. It may be the result of great pressure from forceps during delivery, or the local irritation may arise from a spicule of bone which has been driven into the brain. Hæmatomata, cysts following hæmorrhage, tumors within the skull, either innocent or malignant, syphilitic or tubercular, may cause epileptic attacks.

In some cases where there has been no actual damage done to the skull, injury to the brain tissue itself may have occurred and result in epileptic seizures.

Scars of the scalp and sometimes scars at a distance on a limb, by their irritating pressure on some nerve, may cause attacks.

What is known as "Jacksonian epilepsy," or attacks following a regular course beginning with spasm of certain muscles, is the form which usually indicates some local lesion or source of irritation. The value of "Jacksonian epilepsy" as a localizing symptom was generally denied in a discussion at a meeting of the Paris Academy of Medicine (Gazette des Hopitaux, January 3, 1902), and the writer of the paper under discussion

admitted that in his own cases, although carefully analyzed, it failed to be of much actual service.

However it appears to be the best means we have at present of locating a probable lesion where more certain data for fixing it are missing. By more certain data I mean the presence of scars on the scalp, depressions or elevations of the skull or actual localized thickening of the skull as shown by the X-ray.

It is well to consider the matter of operation carefully before advising it in all cases of epilepsy, even though there is a history of previous injury to which the attacks might be attributed.

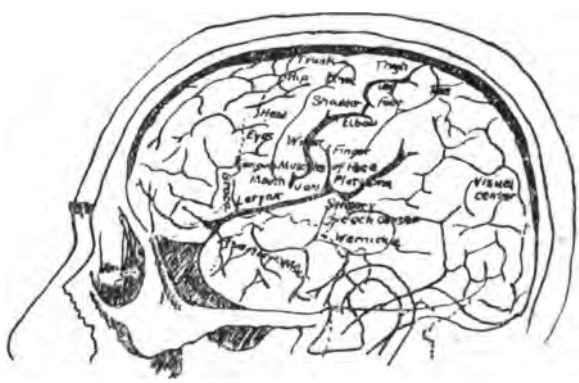


FIG. 12.—Motor and sensory centres of the brain.

Da Costa (Modern Surgery, Fifth edition) says: "Are operations upon the skull and brain curative? Surgeons are much less enthusiastic than they were a few years ago. I believe operation can cure less than 5 per cent. of cases, but it is important to remember that in some cases in which operation seems to have failed, medical treatment becomes much more efficient than it was before the operation. The high rate of cure (70 per cent.) once claimed for operations was due to failing to follow the patient suficiently long. A patient should not be reported as cured until at least three years, and better,

five years have passed without any evidence of the disease. Another source of error was a failure to understand that any traumatism may improve epilepsy *for a time*. The administering of an anæsthetic, the shock of an injury, the traumatism of an operation, just like a febrile seizure, may interrupt an epileptic habit and cause a patient to go for weeks or months without an attack.

"Operation must never be indiscriminately applied. In some cases it gives hope of relief, in others it is obvious that it would be utterly futile. In order to determine if a case is or is not suitable for operation it must be studied with great care. The history must be carefully obtained, particularly as to hereditary predisposition, the first convulsion, and its *supposed cause*. The question of injury, recent or old, should be thoroughly investigated, and it is a sound rule to have the head shaved and then examine for a scar and for a depression. Convulsive seizures must be studied by an expert, hence the patient should be in a hospital, constantly watched by a trained nurse, until one or two fits have occurred. The nurse watches the convulsion and describes it in writing, noting particularly if it had a local beginning. The general health must be investigated."

The cases which seem most favorable for operation are those in which the disease seems to be the direct result of a traumatism on the head, where it is supposedly reflex from some cicatrix or scar (in these cases the removal of the scar is the indicated operation), and in some cases of focal or Jacksonian epilepsy where the attacks have a local onset. "Many of these cases begin in young children who have had infantile palsy, the traces of the palsy having disappeared." (Da Costa.) In these last cases a portion of the cortex surrounding and including the diseased area of brain tissue is removed. Recurrence after a time is the rule, but the attacks are usually lighter

and more amenable to medical treatment, and for even this amount of relief the operation is considered justifiable.

In this connection it may be well to consider for a moment the question of treatment of recent injuries to the head as prophylactic to subsequent epilepsy.

In the case of recent injury to the head some surgeons believe in immediate trephining on the slightest suspicion of simple fracture. Within the past few years very radical work has been done in this direction, but of late there has set in a reactionary sentiment against immediate operation where there are no clear signs of either fracture of the skull or intracranial hæmorrhage, because as is well known, a large number of cases which at first exhibit marked symptoms after an injury, recover with no subsequent bad effects, without operation. A case in point is that of a boy whom I was called to see in Brooklyn. While playing with other boys he fell from a high board fence striking his head on the stone flagging of the yard. He was unconscious for ten days, but with spasmodic twitchings of the facial muscles.

I advised his removal to the Flower Hospital for trephining. The late Dr. Wm. Tod Helmuth, Sr., and Dr. John T. O'Connor saw him in consultation with me at the hospital, and also advised operation, which was set for the day following. On arriving at the hospital the next day I learned that during the night the stupor had passed off, and that the child was awake and apparently all right. Of course, no operation was performed, and up to the last report he was quite well. It must be a matter of judgment, and certainly if in a doubtful case no symptoms arise calling for immediate operation, there can be no harm in waiting for a few days. On the other hand, with clearly defined indications for trephining present, there should be no delay. Patients who have received head injuries should

be kept under observation, and if epileptic symptoms present themselves trephining should be done. I was called to see a young girl who, a year previously, had fallen striking her head on the sharp corner of a box. The point of the injury was about two and one-half inches above and back of the auditory meatus, and easily located. A considerable button of bone was removed, which showed evidence of a stellate fracture followed by callus formation, which made the bone at that point twice the thickness of the surrounding portions. Complete recovery followed.

In November, 1897, a boy five years of age was referred to me who was having on an average thirty-five fits a day, including *petit* and *grand mal*. His parents were afraid to leave him alone for a moment for fear that he would fall and injure himself as he had done scores of times. His birth had been a very difficult one. Forceps had been used and the obstetrician had been obliged to make great pressure in delivering the head.

On November 18, 1897, I trephined the left side over the fissure of Rolando, removing about two and one-half inches of bone. The dura was opened, but as nothing abnormal was found, it was stitched together with fine catgut. The bone was removed and the scalp reunited.

With the exception of two fits which he had soon after the operation, he was quite free from them for nearly three years, during which time I operated on him for hypospadias.

In 1902 there was such a recurrence of the fits that at the parents' earnest solicitation I removed a portion of the skull on the right side of the head, corresponding in size and location to that taken from the left. Since then he has improved greatly. I met his father on the street in April, 1907, and learned that the boy was well and going to school, and bids fair to become a useful man.

It must be borne in mind in deciding whether a portion of the skull shall be removed or not, that the bone will not be reproduced, and the patient always runs a risk afterwards of injury of the unprotected portion of the brain.

H. Delageniere (Archives Provinceales de Chirurgie, October, 1904, Abst. Pract. Med. Series) reports good results in the treatment of epilepsy in a few cases by ligating the longitudinal sinus in two places, the first, four-fifths of an inch behind the fissure of Rolando and the other two-fifths of an inch further back.

In the absence of scars or depressions in the skull for guides a study of the motor and sensory areas of the brain in conjunction with the local muscular spasms must be made. This may require weeks of careful observation on the part of a trained nurse.

TREPHINING.

TREPHINING.—The operation may be performed by any one of several methods. As a rule, the writer prefers the one with the Gigli saw. This saw is nothing more nor less than a highly tempered steel wire which has been roughened. It has loops at both ends to which handles may be fastened after it is in position under the bone.

The day for operation the patient should be prepared by having the head closely shaved and disinfected. With an aniline pencil the site for operation should be indicated. Then the head should be wrapped in antiseptic bandages which are left on until he comes to the operating table.

My reasons for preferring the Gigli saw to the chisel or trephine are that with the chisel there is much concussion from the blows of the mallet.

With the trephine it is not always easy to cut both sides of the circle equally deep, or there may exist unevenness in the thickness at the two sides and there is greater danger of lacerating the brain substance.

Access to the skull is obtained through four or five small openings made by turning up small triangular flaps, as at a, b, c and d (Fig. 14), about one and a half or two inches apart.

These triangles are just large enough to admit the introduction of a small trephine, cutting a quarter inch button.

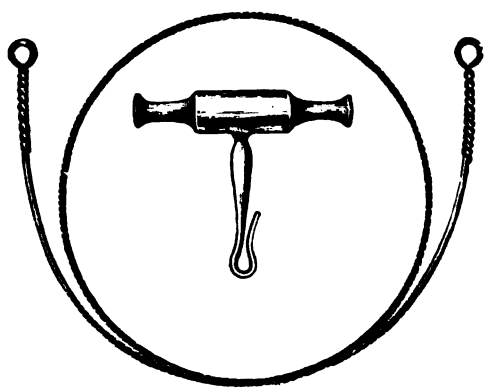


FIG. 13.—Gigli's wire saw.

In cutting these flaps if the side a d is to constitute the base of the flap, care must be taken not to cut so that the neck is too narrow and the nutrition of the flap cut off.

The openings are carefully drilled and the buttons removed. If it has been decided definitely to remove the plate of bone entirely the lines between a b, b and c, c and d may be incised and the flap of scalp turned back. If it is probable that the bone flap will be returned it is better not to cut the scalp along these lines until after the section through the bone has been made, as then it will not be so likely to be stripped off.

After the holes have been bored at the corners, a round

pointed probe is passed from a to b between the skull and the dura. When the end emerges at b, a piece of medium sized silk is fastened to it with a couple of half hitches, and the probe withdrawn. The silk then lies between the skull and dura from one opening to the other. Then one end of the silk is tied into the ring of the Gigil saw, which is pulled through. When it is in position, the handles are attached and the saw made to cut through the bone from within outward. The process may be repeated until the lines a b, b c and c d are

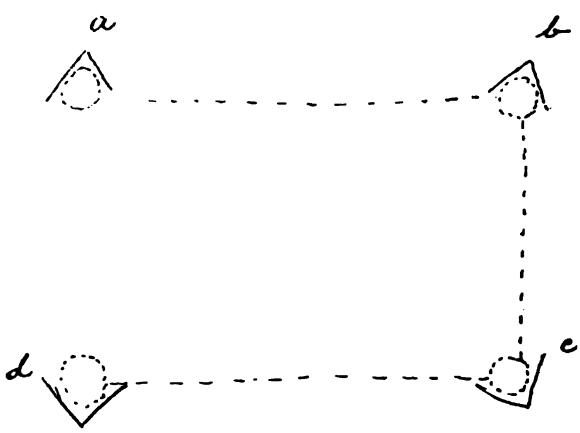


FIG. 14.

cut through. The scalp is incised along the same lines, and then the neck of bone a d is broken with levers and the bone and scalp flap turned back like the lid of a coffee pot. If it is necessary to enlarge the opening still more it may be done with the rougher forceps.

If the method with the chisel is preferred, the scalp along the lines a b, b c and c d is first incised, and with a chisel and mallet a groove is cut which completes the section through the bone, and it is raised as before described. Some operators prefer a saw run by an electric motor, and this works very well.

When the large trephine is used, of course, there is no possibility of preserving the connection between the bone and the scalp.

When the bone has been raised an inspection of the parts underneath may be made, a tumor or cyst removed, hæmorrhage checked, a spicula of bone extracted or thickened bone cut away.

It may be of advantage to cut the bone flaps with beveled edges so that it can be replaced without danger of its becoming depressed. This may be done with the Gigli or electric saws, but not with the trephine or chisel.

Where the bone button has been removed entire, attempts have been made to fill the gap with plates of silver, gold, celluloid, or lead, with some success. In order to prevent adhesion of the brain or membranes to the scalp, gold or silver foil, rubber tissue, Cargile membrane, and egg membrane have been employed. On the whole, the results have not been encouraging. I have used egg membrane in two cases. In one it came away a year afterwards. In the other the final result is unknown. If the dura has been opened it should be stitched with fine catgut. The edges of the scalp should be carefully approximated and proper dressings applied.

After the wound has healed where a portion of the bone has been removed the place should be protected by a light metal plate fastened into a skull cap.

Dr. W. P. Nicholson (N. Y.-Philadelphia Medical Journal, June 3, 1905) advocates the use of celluloid plates (he uses the tops of celluloid powder puff boxes) fastened over the opening. The plates are cut a little larger than the opening in the skull and placed over it between the bone and the scalp and fastened to the skull with silver wires, which pass through holes drilled in the edges of the bone and celluloid plates.

SUBCUTANEOUS CRANIOTOMY.

In the hope of relieving the pressure on the brain and allowing it to develop in cases of microcephalic children, I devised the operation of subcutaneous craniotomy. It consists of an extension of the operation already described of trephining with the Gigli saw, the difference being in the much larger area of the bone raised, the fact that all the cutting through the bone is done subcutaneously except where the little tri-

FIG. 15.—Operation of subcutaneous craniotomy. Gigli saw in place. Dotted lines indicate line of section through the bone.

angular flaps are turned up to allow of the introduction of the small trephine, and the beveling of the edges of the bone.

The dotted line in the cut will show the extent to which the section can be made, care being taken to avoid wounding the longitudinal sinus and the main trunk of the temporal artery. The bone may be raised on one or both sides of the head, and

so long as the dura mater is not injured and asepsis is strictly maintained there is comparatively little danger.

The directions have already been given for the use of the Gigli saw. In this operation the openings in the scalp are not united by incisions, but the saw is passed through small openings made by turning up small triangular flaps. When the saw is in position the section through the bone is made by drawing it sidewise so that the edges of the portion of bone to be raised shall be bevelled, and it is wider on its outer than its inner surface. In other words, the section raised is like a stove lid, and fits into its place, but can not be depressed inward on to the brain.

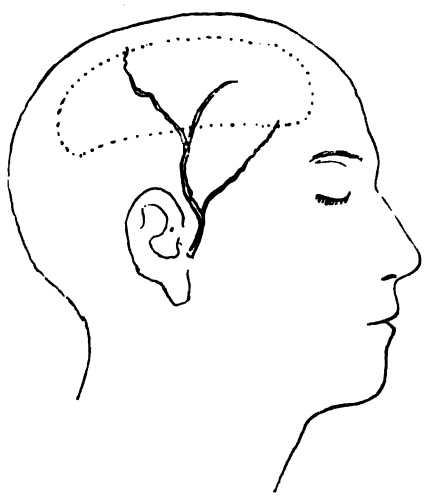


FIG. 16.—Position of temporal artery. In using the Gigli saw in subcutaneous craniotomy it may be well to make the section above the division of the artery, although if care is used it need not be injured.

While it has seemed advisable to mention this operation in the hope that it might prove serviceable in the hands of some one else, I must confess that in my limited experience with it I have not seen much benefit. It is probable that in cases of microcephalus the trouble is not so much that the brain is

prevented from developing by the thickness and pressure of the skull, as that the brain is of poor quality and small size originally, and possesses slight possibility of development under the best of conditions. Also it should be borne in mind that even after raising a portion of the bony skull the tense fibrous dura mater gives but little opportunity for expansion.

DEFORMITIES OF THE EXTERNAL EAR.

The most frequent deformity of the external ear is projecting auricle, or, as it is commonly known, prominent ears.

This prominence of the auricle may be a matter of great annoyance to the mother during the early age of the child, and later on to the patient.

During infancy, while the cartilage is soft, much may be accomplished by keeping the ear bandaged tightly back to the head, or it may be held back by a cap, such as is sold for the purpose at children's furnishing stores.

Later, after the cartilage has become hardened an operation will be required. This consists in the removal of an elliptical piece of the cartilage and skin from the posterior surface of the ear (not cutting through the skin on the anterior surface), and a piece of skin of the same size and shape from over the mastoid. In order to have both pieces of the same shape it is advised to press the ear back onto the mastoid before the incision, and mark where the two come together. The whole denudation may be done in one piece. Some surgeons advise the *thinning* of the cartilage by scraping or cutting it away instead of removal of the entire thickness.

When the denudation is completed the parts should be accurately stitched together and a dressing and bandage applied

to take off the tension. The ears should be kept bandaged until healing is complete.

Occasionally, at birth, the helix or lobule of the ear may appear to be missing. The helix is sometimes buried under the skin, and if it does not project normally as the child grows, it may easily be released from its confinement by a simple incision, and possibly a slight plastic operation may also be required to which the inventive skill of the operator must be applied. Many persons have no lobule, but if it is present and buried it may be easily released.

MACROMELIA

Macromelia is the term applied to monstrous growth of any part. It is a form of lymphangiomata, and is thought to be due to obstruction of the lymph channels. It is essentially a vice of development and congenital.

Macroglossia is where the disease affects the tongue, which protrudes from the mouth and becomes deeply fissured. The lips are everted and the teeth loosened and pressed outward. Deglutition, respiration and speech are interfered with.

An excellent description of a case occurring in his own practice is given by the late Prof. William Tod Helmuth, Sr., M. D., in his Surgery. When the lip is the seat of the disease it is called *macrocheilia;* the fingers, *macrodactylia;* the foot, *macropodia.*

Where it affects the digits or some other easily accessible parts amputation is called for.

Macroglossia may be treated by the removal of a V shaped piece and bringing the flaps together, or, as in Prof. Helmuth's case, by the eccrasseur, trimming off the sides even with the

lips and allowing the remainder of the tongue to shrink, as it did satisfactorily in his case.

Macrocheilia, or enlargement of the lips, may be removed by operation, but by many surgeons this is considered dangerous, some of them preferring the injection of irritating fluids, such as tincture of iodin or solution of chloride of zinc, although this method has its dangers. (Keen's Surgery, Vol. II., p. 607.)

FIG. 17.—Author's case of macrocheilia (left side) before operation. (This cut is made from a tintype in which the sides were reversed.)

Of this condition Whitehead writes: "It consists, pathologically, in a dilatation of the lymphatic spaces which everywhere pervade the tissues of the lip. Accompanying this dilatation and as a result, no doubt, of the excessive nutrition, there is some true hypertrophy of the tissue." ("Manual of Surgery," Treves, Vol. III, p. 42.)

Gross adds: "The inner edge of the tumor is dotted with numerous orifices, which are simply the mouths of enlarged follicles, and which are constantly bedewed with mucous fluid standing on them in small drops." ("System of Surgery," Gross, Vol II, p. 434.)

The case shown in the cuts is one upon which I operated in 1887, and reported in the N. A. Journal of Homœopathy, May, 1888. A brief abstract of the report is given herewith:

FIG. 18.—Same case as in Fig. 17, after operation.

Thomas M———, aged four years. Healthy and well developed. The child was born with the upper lip and cheek greatly enlarged. The lip was not only more than three times the thickness of the lower one but it was greatly increased in other dimensions. It hung down over the under lip, and being longer on the left side than the right, that angle of the

mouth was about three-quarters of an inch lower than the right, and about the same distance further laterally from the median line of the face than the right.

The left cheek hung down and projected much further outward and forward than the right, giving him the appearance of suffering constantly from an ulcerated tooth. On the mucous membrane were three patches covered with hypertrophied follicles, which projected like white, hard papilla from the surface of the membrane, and presenting the peculiarly rough appearance of a cow's tongue more than anything else. Two of these patches covered the inner surface of the lip and the other extended back along the inner side of the cheek. The feel of the lip and cheek was tougher and harder than that of the opposite side.

The mother attributed the deformity to the fact that about the fourth month of pregnancy she was greatly frightened by having a large, live snapping turtle thrown at her. In May, previous to the operation, the boy was taken ill with a violent inflammatory swelling of the cheek. He had a high temperature and rapid pulse, the swelling was very hard and tense, and the eyelids œdematous and closed. He was ill intermittently for about four weeks, and apis was the only remedy that was of any use.

Up to the time of this illness the mucous membrane had been smooth, but after his recovery the above described condition of follicular enlargement was found to be present. No pus formed except in a little boil which opened on the cheek.

Three operations in all were performed at the Laura Franklin Hospital. Essentially they consisted in splitting open the lip and cheek and removing a wedge-shaped piece, the base being at the vermilion edge of the lip. Bleeding was very profuse and difficult to control. Recovery from the operation was followed by great improvement in appearance.

HARELIP.

At about the thirtieth or fortieth day of fœtal life the fissures of the face close, leaving the normal openings and grooves. In some cases closure fails to take place and congenital deformities are the result. The most frequent deformity is known as harelip. It may exist in varying degrees from a slight notch in the vermilion border just a little to one side of the median line, to a cleft in the lip leading up into the nostril. Or the deformity may be bi-lateral with two clefts and a small tip projecting down between them. Harelip

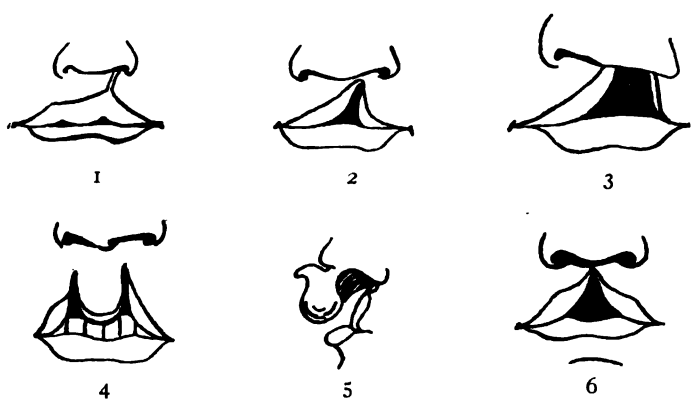


FIG. 19.—Varieties of harelip (Holmes). 1. Partial harelip. 2 and 3. Complete harelip. 4. Double harelip. 5. Double harelip with projecting teat (v. Bruns). 6. Median cleft of the upper lip.

may be complicated with either single or double cleft palate, and in some cases the intermaxillary bone projects forward carrying with it the middle portion of the lip, and is apparently attached to the tip of the nose.

The only remedy is operation, and until lately it has been advised to operate very early in infant life. Where the harelip is uncomplicated with cleft palate this advice still holds good, because there is no reason for waiting; while on the

FIG. 20.—Nelaton's operation. A, the incision; B, flaps drawn down for approximation.

FIG. 21.—Mirault-Langenbeck operation. A, the incision; B, position of flaps for approximation.

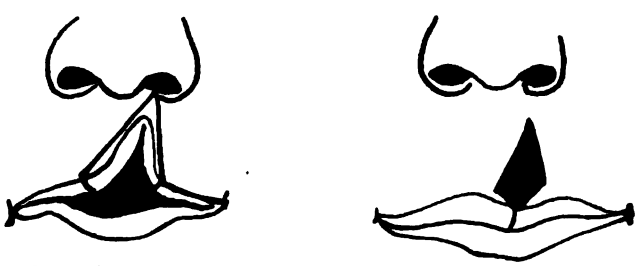


FIG. 22.—Malgaigne's operation. A, the incision; B, flaps drawn down for approximation.

FIG. 23.—Mirault's V shaped freshening and incision for double harelip.

other hand, a disfigurement is removed early. Another reason for early operation is that it can be done with little disturbance or pain to the child. During the early days of life sensation is not acute, and an operation is felt much less than later. Also, when the child is very young it is much less likely to disturb the wound with its hands. Repair also takes place rapidly at this period.

Although the operation is a small one it must not be considered a simple one, for, unless the operator is skilful and understands the conditions involved he may have as a result a living advertisement of his inability.

FIG. 24.—Brown's method of applying straps to prevent traction on the sutures after operation for harelip.

For the repair of harelip the incision must depend on the conditions present. The various incisions shown in the cuts may be adapted as required.

Whichever incision is used the method of uniting the wound is of importance.

The technique of approximation described in surgical works of only a few years back was crude. The use of the old figure of eight sutures with harelip pins is unnecessary, and is likely to be followed by disfiguring scars.

The method which I have employed for several years has given good results.

First. The sub-mucous portions of the lip are drawn together with a buried suture of fine catgut. This draws the edges of the mucous membrane together without leaving any of the sutures exposed in the mouth.

Then interrupted sutures of sterilized horsehair are used to approximate the skin edges. The advantage of horsehair is that it is sufficiently strong, while on the other hand, it is so thin that if it cuts at all the mark is so fine as to be almost invisible. The sutures may be reinforced by a strip of gauze, or, better, sterile chiffon passed across the lip and pasted to the cheeks with collodion. Through the thin chiffon the wound can be observed without disturbing it, and dressings may be applied and removed without relieving the traction. The sutures may be removed after three or four days, but it is well to keep up the support of the straps for a week or ten days to avoid stretching of the scar.

TONGUE TIE.

When the frenum of the tongue is abnormally short it will prevent the child projecting its tongue forward and may cause some difficulty in sucking, and later on interfere with speech. It is claimed by authorities that if the child is able to project the tip of the tongue forward beyond the lower teeth no operation is required.

The remedy consists in clipping the anterior cord-like edge of the short frenum with a pair of scissors and then tearing back the tissues with the fingers until sufficient freedom of movement is obtained.

While cutting, it is well to protect the lower side of the tongue along which the artery runs, by slipping the slot of a grooved director on to the frenum and cutting on it.

CLEFT NOSE.

Cleft nose is a much less frequent congenital deformity than either harelip or cleft palate. The accompanying cut shows a sketch of a case on which I operated at the New York Medical College and Hospital for Women during the past season with a good result.

FIG. 25.—Sketch of author's case of cleft nose.

The method of operating is similar to that for harelip, only simpler. In denuding the edges of the cleft care should be observed to remove only the thinnest shaving of tissue possible, as the nostril will be very much contracted if too much is taken away.

BIFID OR SPLIT TONGUE.

This condition may occur congenitally. The tongue is divided to a greater or less extent by a longitudinal fissure into two unequal parts.

The remedy consists in paring the edges of the cleft and approximating them with sutures. If the condition does not interfere with feeding the operation may be deferred until convenient.

On account of the great vascularity of the tongue, wounds of that organ heal rapidly in spite of the fact that antiseptics can not be used or dressings applied.

CLEFT PALATE.

When approximation of the edges of the vomer and the palate bones fails to take place in fœtal life, the child is born with the defect known as cleft palate. In some cases the bones may unite while the edges of the soft palate do not, and the cleft is confined to either the whole or part of the soft palate and uvula. Sometimes a bifid uvula is the only defect.

There may be a single or double cleft. It may be complicated with single or double harelip with the intermaxillary bone projecting forward as though attached to the tip of the nose.

In extreme cases the condition is most pitiable, and the appearance revolting to the sight. Many of the extreme cases die within a few days after birth from lack of nourishment, as it is sometimes impossible to arrange any form of apparatus for feeding them.

In some cases feeding may be done with a spoon: or a large

nipple, which fills the whole mouth, may be used. Sometimes a nipple with a large shield fastened on its upper side is used, the shield acting as an obturator to close the cleft.

The only remedy is by operation: and as Brophy, of Chicago, has demonstrated within the last few years, it is better to operate in the early weeks of infant life.

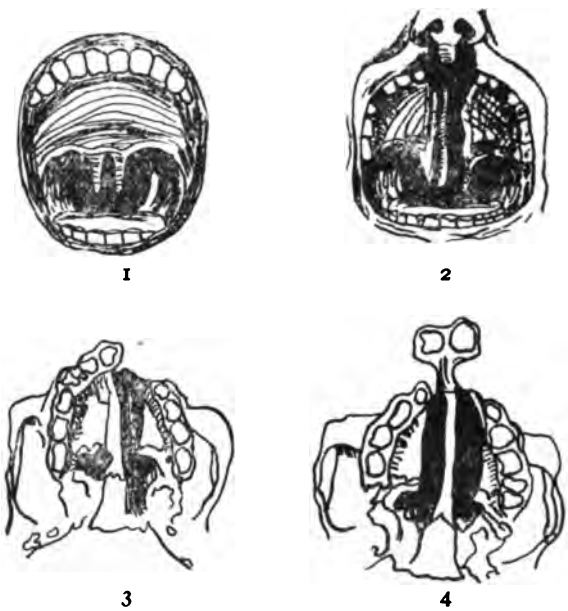


FIG. 26.—Varieties of cleft palate (Brophy-Holmes). 1. The bifid or cleft uvula (urancolobom). 2. The most extensive cleft palate and double harelip (uranochisma bilaterale). 3. Left-sided cleft. 4. Double cleft.

There is a certain amount of risk in operating on very young babies, and that is the danger of aspiration pneumonia, the little patients being unable to eject the infectious material which may be drawn from the mouth into the lungs.

For this reason it has been the rule to wait until the child was from four to six years of age; but to unite a complicating harelip early, so that the constant traction of the lip might

have a tendency to diminish the cleft in the palate. In any case one should not wait later than the sixth year, because by that time the child becomes accustomed to using the deformed muscles in an abnormal way in talking, and it is very difficult to change the method after operation.

However, as shown by Brophy, muscles of the palate through disuse become atrophied, and even after operation, at the age of six years; speech is never perfect.

All the arguments in favor of the late operation apply correctly in cases of incomplete cleft or where the soft palate only is affected.

Brophy's investigations and wonderful range of experience with this condition has changed opinions regarding the advisability of early operation to a great degree.

He has shown that in case of complete cleft there is not an actual deficiency of bony material, but instead, a failure of approximation and union. In other words, the two sides of the upper jaw are spread apart so that it is wider than the lower one, and the alveolar processes of the upper jaw overlap and come down outside the lower one. If nothing is done to remedy this, the lower jaw acts like a wedge which its muscles (masseters, etc.) continually push upward, with the tendency always of forcing the ununited halves of the upper jaw further apart.

It is to obviate this condition as well as get early action of the palate muscles, and also to take advantage of the malleability of the imperfectly ossified upper jaw that Brophy advocates early operation. In these cases operation on the harelip is postponed in order that advantage may be taken of the greater space to work in which is afforded by leaving the cleft open.

If a child with complete cleft palate is examined shortly

after birth, it will be found that the edges of the bones can be almost if not quite forced together with the hands. The bones are quite soft at this period, and there is slight danger of disturbing the relations of the parts at the base of the skull which would occur if the operation were postponed until after the bones had become hardened. If there is too much resistance, Brophy's forceps may be used to force the bones together.

For any operation for cleft palate the child is placed flat on its back on a table, with a sand bag under its neck in order to allow the head to drop back. Sometimes the head may hang down over the end of the table, but resting on a shelf or lower

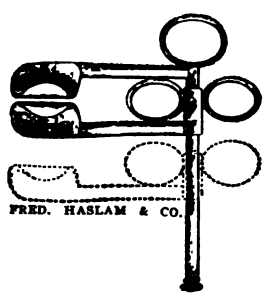


FIG. 27.—Murdock's mouth gag.

table. This position allows the blood to collect in the vault of the pharynx and not run down the throat.

The light should be so arranged that it shines directly on the field of operation. Chloroform largely diluted with air and blown through a tube introduced into the nose is the best for an anæsthetic, although the newly described method of rectal anæsthesia offers great possibilities in older children. (Leggett, Annals of Surgery, October, 1907.)

During the operation the anæsthetist should have beside him a tumbler of water in which has been mixed a teaspoonful of aromatic spirits of ammonia. If at any time the child appears to do badly a few drops of this mixture are dropped into its mouth.

When the edges of the palate bones and the vomer have been approximated, they are held together by means of heavy silver wires passed from one alveolar process across the mouth to the

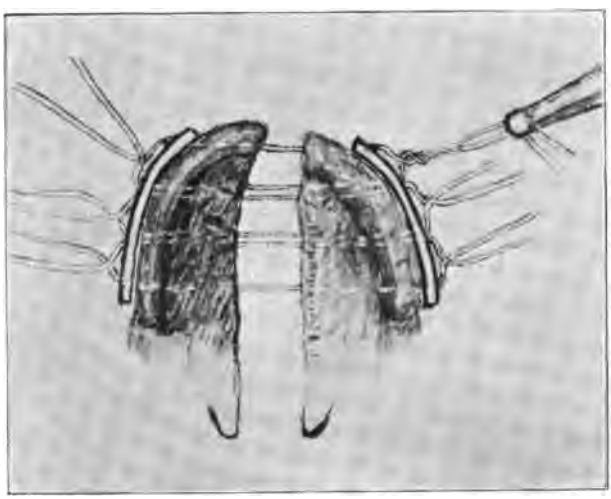


FIG. 28.—Brophy's operation. The wires passed across through the alveolar processes from one side to the other. The cut shows the wires in position to be twisted tightly over the lead plate as the edges of the cleft are pressed together.

FIG. 29.—Brophy's operation. Cross section showing approximation of edges of palate bones as the wires are twisted tight.

other. The ends of the wires pass through lead plates moulded to the outer surface of the alvolar processes, and when all the wires are in position the ends are pressed down flat so that the inner surface of the cheeks will not be lacerated by the sharp ends.

The placing of the silver wires is accomplished by, first, passing loops of strong silk from one side to the other. The wires are hooked into the loops and drawn through. The best instrument for carrying the silk is a stout needle with an eye in the point and fitted to a handle.

If the premaxillary bone projects, it must be fractured and pushed back into place and held by a piece of silver wire passed in front of it. After securing the ends of the wires the edges of the newly approximated surfaces are freshened by scarifying them thoroughly with a fine narrow bladed knife which has a saw edge and rasping sides. Then the sutures are tightened slightly to bring the edges more firmly into position. In most cases it is not advisable to attempt to repair the soft palate at the first operation. It is safer to leave it until later, when the lip may also be operated on.

The wires should be left in place for several weeks if possible, but constant attention must be given to cleansing them, to prevent the accumulation of infectious matter in the mouth.

After the operation, and later, if required, the nose can be washed out by turning the child well over on the side with the face downward, and syringing through the nostrils with a solution of boric acid. If the child is held as directed, the solution runs readily out of the mouth.

Boracic acid solution, or peroxide of hydrogen solution, on small swabs may be used for cleansing the mouth.

An excellent old fashioned mixture for cleansing the mouth is composed of equal parts of glycerine and vinegar.

Where the child has not been operated on in early infancy the old operation must be performed.

If only the soft palate is involved, its edges should be carefully pared and then united with silk or preferably iron dyed silkworm gut sutures. To relax the traction of the tensor

palati muscle one should feel along the soft palate with the tip of the finger after the sutures have been tightened, and the cord-like structures underneath the mucous membrane divided either with a knife or a pair of sharp pointed scissors.

In all operations on the cleft palate the mouth gag is of importance. Several varieties are in use, but I have found a flat cork which has its edge deeply grooved, and to which is secured a stout cord, to be as easily managed as any of the more complicated gags.

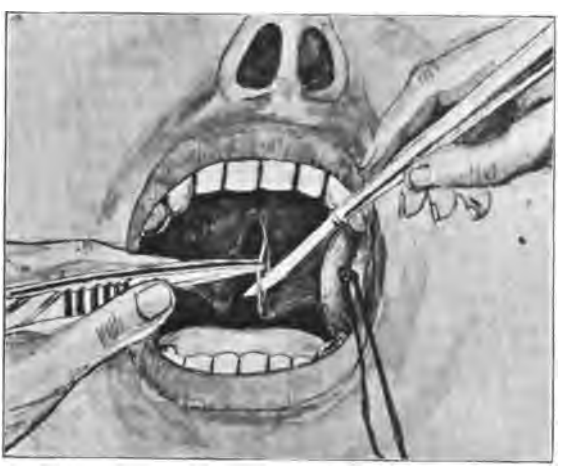


FIG. 30.—Method of paring the edges of the cleft. The cork mouth gag is shown in position.

Where the hard palate still remains cleft until too late for Brophy's method, as previously described, the old operation of sliding muco-periosteal flaps from the sides of the roof of the mouth towards the middle, to cover the cleft must be resorted to.

After the edges of the cleft have been thoroughly pared, deep incisions, running close to the alveolar processes and down to the bone, are made on either side. Then with a blunt dissector these flaps are lifted from the bone until they are attached

only at their ends. This portion of the operation is usually very bloody and tedious, but the bleeding usually stops when firm pressure is made for a few minutes. When the flaps are quite free, sutures are inserted and the edges of flaps approximated along the median line.

FIG. 31.—Incision for cleft of hard palate indicated by heavy line just inside the alveolar processes.

FIG. 32.—Operation completed. Flaps drawn to median line and united leaving denuded bone on each side.

Various forms of suture material are used, but I have found iron dyed silkworm gut to act as well as anything. The great *desideratum* is that there be absolutely no traction on the sutures or they will surely cut out and the operation be a failure.

The lateral openings left by sliding the flaps heal quickly by granulation.

Dr. George V. I. Brown reports (Lecture before the Acad-

emy of Pathological Science, N. Y., February 28, 1908) remarkable results in reducing the deformity and narrowing the cleft by the use of a simple strip of Z. O. adhesive plaster applied tightly across the face, claiming that the action of the muscles when held by the strip tends to pull the separated edges into apposition. This avoids the crushing methods already mentioned, and does not involve the loss of the tooth germs. The strip should be applied as soon after birth as possible, and usually the edges of the cleft are in apposition by the end of

FIG. 33.—Brown's method of applying adhesive strip to effect approximation in cases of cleft palate.

ten days or two weeks when they can be easily sutured. When the harelip is repaired it is supported by two strips of Z. O. plaster, one running up over the nose and the other above the chin, thus puckering the mouth in such a manner that there is no possibility of lateral traction on the sutures.

For traction sutures to hold edges of the muco-periosteal flap of the palate he uses aluminum bronze wire clamped over square silver plates with perforated shot.

For the coaptation sutures he uses pyoktannin gut prepared by the Ramsey Co. Medical Society, of Minnesota.

NOMA, CANCRUM ORIS.

Noma occurs almost exclusively in children under ten years of age. It is a rare form of microbic gangrene, usually involving the mouth and cheek, although it may involve the vulva and even the skin of other parts. It always follows some debilitating disease, and girls seem to be more susceptible than boys. Epidemics have occurred, but most of the cases are sporadic.

Some micro-organism, not yet definitely recognized, appears to be the primary cause, but the disease always follows some other debilitating disease, probably one-half the cases following measles. In a recent case of noma of the vulva referred to me by Dr. Fannie Donovan Conklin, of Staten Island, the disease followed marasmus.

Beginning usually as a simple ulcer upon the mucous membrane of the mouth or lip, infiltration of the mucous and submucous tissues takes place, which become dusky red, then purple and black. The borders are infiltrated and dark red.

Gangrenous sloughs form and separate, deep cavities form or widespread areas are affected, and the discharge is horribly offensive.

Considerable areas of tissue may be destroyed. Holes may be eaten through the cheek, bones laid bare or affected, and if it occurs at the vulva it may extend to the perineum and septum, destroying them. The patient usually has a high temperature, but not always, and is profoundly septic. The temperature may fall later. The mind is usually clouded; as the disease progresses the pulse is feeble. Remissions of the disease should not lead to false hopes of immediate recovery because exacerbations are likely to occur. Ten days to two

weeks is the usual duration of the disease, and about 75 per cent. of the cases die in that time. (Keen's Surgery.)

Recovery is accompanied with great deformity. In one case coming under my care some years after the disease when the patient had grown up, I found the nose, the upper lip, portions of the cheeks and both lower eyelids gone. Of the nose absolutely nothing was left, even the bones were gone, and only two holes showed the location of the nostrils. By using a bridge made of silver I was able to make a nose by turning a flap from the forehead. This greatly improved her appearance, but it was impossible, on account of lack of tissue, to restore the upper lip and eyelids.

The case of noma of the vulva before mentioned was in a little girl fifteen months old. She had been suffering from marasmus. When I saw her she had all the symptoms of sepsis with a temperature of 104°.

The labiæ were intensely tumefied, hard and dark red or purple. The redness extended back onto the perineum. Sloughing had not yet begun, but there were black spots on the labiæ.

The treatment most advised is destruction of the affected portions with nitrate of silver, bromine, carbolic acid, or the actual cautery; continuing the cauterization down to healthy tissues. Some surgeons prefer curettement followed by chemical cauterization, while others prefer excision by the knife.

At a meeting of the New York Medical Club (October 26, 1908), in a discussion on the subject, Dr. St. Clair Smith related his experience with a number of cases at the Five Points House of Industry, and stated that the use of a saturated solution of chlorate of potash applied locally as a wash and on compresses, with the administration of the same remedy in the first decimal trituration, had saved many cases.

SURGERY OF THE THROAT, NOSE AND EAR.

BY HAMPTON P. HOWELL, A. M., M. D.

ADENOIDS.

FREQUENCY.—At least eighty per cent. of the diseases of the nose, throat and ear are due to adenoids, either alone or in connection with enlarged tonsils; the evil consequences of which, if not attended to, usually exist through life. Hence the importance of an early recognition of these conditions and their prompt removal.

DEFINITION.—Adenoids can be defined as an increased growth of lymphoid tissue in the nasopharynx.

This is a normal development in childhood, and just when it can be considered pathological depends upon the relative size of the space and the lymphoid tissue.

AGE OF OCCURRENCE.—They are found most frequently between the ages of three and ten years, though it is not at all rare to see cases occurring as early as the fourth month. No grade of society seems to be exempt, for the children of the well-to-do are quite as often afflicted as the children of the poor.

CAUSES.—Factors in the etiology seem to be heredity, infectious diseases, causes which produce nasal obstruction, indigestion and errors in diet, especially in children who consume too great a quantity of sugar, according to Kerley. A moist, variable climate, or sudden changes in temperature, as going from overheated apartments into cold outside weather, seem to lead to adenoid growths. St. Clair Smith has observed that children compelled to remain indoors all winter for the first two years of life do not suffer often from adenoids.

A fresh specimen of the growth removed *en masse* is found

to consist of a soft friable structure, which is lobulated and resembles closely the half of the meat of a hickory nut. Microscopically, it is composed of groups of round cells held together by fine trabeculæ of connective tissue of very loose formation. An adherent mass occupies the central part of the vault of the nasopharynx, and extends along the posterior wall nearly to the free border of the soft palate. Lateral developments may take place at the orifices of the Eustachian tubes. Adenoids are much increased in size during acute attacks, and covered with muco-purulent secretion which also dips down

FIG. 34.—Typical adenoid. (Waggett.)

into the sulci. Thus it can be readily appreciated how an infectious process in this locality can extend to the middle ear.

A baby that has frequent running nose, who snores, who wakes easily, is restless and irritable, and has small cervical glands felt high up in the neck, is probably suffering from adenoids. Owing to obstructed breathing the child is anæmic, undersized, may have attacks of laryngismus stridulus and other reflex disturbances. A young infant is not a mouth breather unless the obstruction is very considerable; so in these cases we must not lay too much stress upon this particular sign.

In older children the symptoms are more evident. We observe the heavy listless expression, the flattened nasal folds, the thick lips, the dropped and receding jaw, the pinched nose and compressed alæ. Add to these symptoms defective hearing

or running ears, a nasal twang to the voice, an inability to blow the nose, an ill-developed chest, slow mentality, and often a morose disposition, and one can but feel the responsibility of directing these little sufferers aright as soon as possible.

We must interfere, too, before the age of second dentition, otherwise the individual fails to develop into the vigorous man he otherwise would. The reason for this is that at this period of life rapid changes are taking place; the child is fast losing the rounded pudgy features of babyhood, the accessory sinuses

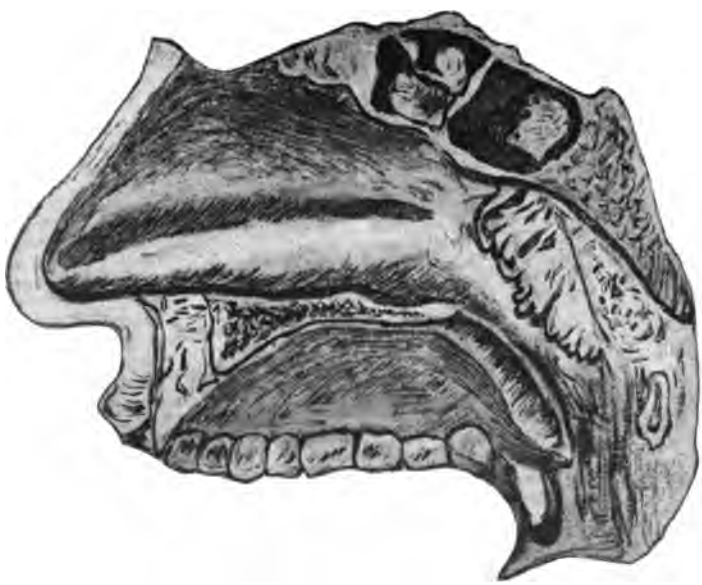


FIG. 35.—Section showing lymphoid hypertrophy in naso-pharynx. (Zucherkandyl.)

are extending into their respective bony regions, and the expanding hard palate is giving a proper conformity to the alveolar arches by the action of the tongue. It is not generally stated that the tongue does not lie relaxed on the floor of the mouth; on the contrary, in the normal individual it is always in a state of moderate tonus, pressing up against the hard palate, shaping and moulding it by its constant pressure. However, if the

naso-pharynx is obstructed the child is compelled to become a mouth breather. That being the case, the tongue can not perform its moulding function, and the alveolar arches do not broaden out. Therefore, on account of insufficient room the permanent teeth come in irregularly; and from constant exposure to the air they decay at an early date. The narrow, high-arched hard palate causes the nasal septum to deviate to one side. As the nose is not used for breathing purposes it becomes thinned and ill-developed, so that even normal sized turbinated bodies are relatively too large.

It can, therefore, be understood what a part the adenoid facies plays in the rhinological complaints of adults.

DIAGNOSIS.—The diagnosis is made by the nasal voice, the facial expression, the irregular teeth, the high groove-like alveolar arch, the presence of ropy mucus hanging down the posterior wall of the pharynx, and the presence of a mass in the naso-pharynx. To elicit this latter fact a small post-nasal mirror can sometimes be used in a child over eight years of age. In such a case we at once try to identify the vomer; if the upper half of this is obscured from view, and there is an indistinct mass in the naso-pharyngeal vault, we can be pretty certain we are dealing with adenoids.

Oftener, however, a finger must be used for diagnosis. To describe this method, in brief, we press the child close up to our left side, and have him open his mouth, then by pushing his cheek in between his jaws, to prevent his biting, with our left index finger, we slide the right one over the right tonsil in order to prevent excessive discomfort on the part of the child, and feel up behind the soft palate, hastily, but methodically, examining the post-nasal space. First define the septum, then proceed along the top of the naso-pharynx and down its posterior wall. Adenoids, if present, impart the sensation of a

soft friable mass, and on withdrawing the examining finger it has on it some blood stained mucus.

Adenoids must be differentiated from polypi, solid tumors of the naso-pharynx and malignant disease. If a polypus, it will be found attached in front to a turbinated bone, and others will probably be found in the nasal cavities. A fibroid growth will be hard and smooth, and very movable, owing to the fact that it is pedunculated. A malignant tumor has a discharge, bleeds spontaneously, grows rapidly, and the patient soon begins to lose flesh.

TREATMENT.—A change of climate will cure a small percentage of cases, also diet, tonics and sprays will benefit. But after all, such methods are slow and unsatisfactory. Removal by operation is so quickly effected, and with a minimum of after-treatment, that it should be urged in all cases except acute illness, serious chronic disease and hæmophilia.

If there is an acute attack of otitis media there are those who advocate the operation for adenoids if present, at the same time that a paracentesis is done, reasoning that an adenectomy will relieve the patient of the causative factor and at the same time facilitate drainage. Still in such a case the writer would prefer to wait unless both ears required paracentesis.

While in the crowded work at clinics a general anæsthetic may not be given, in private operations it is to be preferred.

Chloroform is a pleasant anæsthetic, but numbers of cases of sudden death have been reported, due to the so-called *status lymphaticus* occurring in this particular class of children. Nitrous oxide is objectionable in that the cyanosis causes undue bleeding; while ether has this later feature and also causes bronchorrhœa.

Ethyl chloride is perhaps the most satisfactory anæsthetic, safe and easy of administration, using either a specially devised apparatus or the ordinary chloroform inhaler. The effects of

this anæsthetic remain just long enough for a case of adenoids and tonsils.

The operation can be done in the sitting posture, though generally it seems better to get accustomed to performing it with the child on a table.

The only instruments necessary are a mouth gag, a Gottstein curette and a small adenoid forceps. It is well to have a crico-thyrotomy tube and guide for emergencies, and some cotton holders. The original Gottstein model was triangular in shape, and had a tendency to sweep aside the growth like the prow of a boat, so that one modified to a quadrilateral form and rather short, antero-posteriorly, to allow for a good sweep has been found to be of greater service. Many operators use some sort of an adenoid forceps to remove the greater part of the tissue and reserve the curette for the final smoothing off of

FIG. 36.—Frothingham's modification of Gottstein's curette.

the surface. The use of an instrument is a matter of choice, but we would advise the curette as being the safer method, as the forceps can easily bite away a portion of the septum and even tear away periosteum from the vault. With the curette, however, it would be difficult to remove more than the growth itself.

The child being under the anæsthetic with body and arms wrapped in a large towel, the table is brought over near the window. The mouth gag is inserted and the largest sized curette that will fit the naso-pharynx is selected. This is slid along the tongue and up behind the soft palate. The instrument is then brought into position in the median line and the growth is engaged well anteriorly, by depressing the handle

against the lower teeth. Now, rather firm pressure is made upward, backward and then downward. In this way the major part of the adenoid is brought away in one stroke of the instrument. After this a single sweep on either side of the median line can be made to remove remaining material. The patient is then turned well over on the face, for the hæmorrhage is brisk for a minute or two. If the bleeding continues much longer than this, or if there is coughing and strangling, it is usually because the curette was not carried far enough down the posterior wall, and some of the tissue remains attached by a shred of mucous membrane, and so plays back and forth with every respiration. This tag must be seized with forceps and cut off.

Unless there is temperature and discharge no local after-treatment is necessary. If indicated a mild alkaline nasal spray can be used.

The child should be kept in bed for twenty-four hours and in the house the next two days. The first day milk, broths, meat-jellies and ice cream are allowed. Recurrence takes place in ten per cent. of these cases, and it is well to warn parents of this possibility before operating.

If there has been any cause for the naso-pharyngeal growths, such as nasal stenosis and faulty condition of the general health, or of the mucous membrane, these should receive appropriate treatment. The operation removes the chief impediment, but the bad use of the voice, mouth breathing and facial expression have become habits, and only by care and attention to details may these conditions be removed.

This sort of after-treatment is quite as important as that which should follow in the case of a fracture near a joint.

ENLARGED FAUCIAL TONSILS.

Adenoids and hypertrophy of the tonsils are frequently found together in children.

The lymphoid tissue of the throat is arranged in a double circular manner. The inner ring is composed of the adenoid structure of the naso-pharynx behind, chiefly found in the

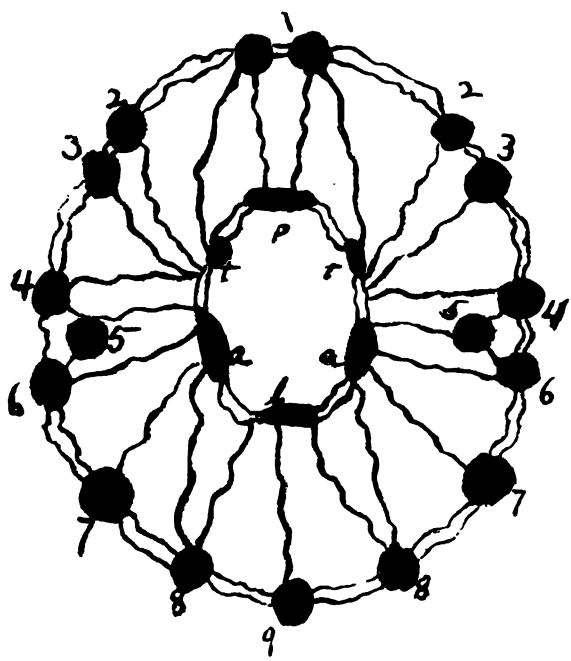


FIG. 37.—Diagram of Waldeyer's lymphatic ring and its connections with the lymphatic system. (After Escat.) 1. Retro-pharyngeal. 2. Styloid. 3. Lateral pharyngeal. 4. Behind sterno-mastoid. 5. Bifurcation. 6. In front of sterno-mastoid. 7. Angle of jaw. 8. Hyoid. 9. Sub-hyoid. p, Pharyngeal; t, tuba; a, faucial; l. lingual tonsils.

central portion of the vault, but sometimes developed around the Eustachian orifices, the faucial tonsils at the sides, and finally that found at the base of the tongue, spoken of as the lingual tonsils. The outer ring is made up of the lymphatic

glands of the upper part of the neck. This entire system has been given the name of Waldeyer's lymphatic ring, and is important in bringing to our attention the intimate relation of all these glandular structures to one another.

Where the tonsils are hypertrophied there is an increase in all the histological elements of the gland, and whether consisting of the hard or soft variety depends upon the overgrowth of lymph follicles or connective tissue stroma. The crypts are often dilated and contain material which acts as a nidus for attacks of follicular tonsillitis. The commissure above the tonsil may contain a collection of organic matter which, undergoing putrefaction, may be a cause of inflammation in the peritonsillar tissue, a condition quite rare, however, in small children.

Any of the following symptoms may be present: a child not in very robust health, frequent attacks of sore throat and a constant hacking cough; there may be a sensation of a foreign body in the throat with perhaps some pain on swallowing; the voice is muffled and phonation interfered with, due to pressure at the base of the tongue and side of the pharynx. Sometimes the patient may have an impairment of hearing, or an otitis media, the infection travelling up from the throat. From the frequent association with adenoids we have the symptoms of that disease added. In fact, the symptoms imperceptibly shade into one another.

EXAMINATION.—On examining the throat in one class of cases we find the enlarged tonsils bulging between the pillars of the fauces, one often being larger than the other. Sometimes the hypertrophy is so great that they meet in the middle line. In another class of cases, especially after repeated attacks of acute tonsillitis, the tonsils are found bound down by the anterior and posterior pillars, so that first inspection does not

demonstrate the real enlargement. These are the so-called buried tonsils, causing the patient to retch on palpation or by freeing the adhesions the condition becomes evident.

INDICATIONS FOR OPERATION.—Tonsils undoubtedly do atrophy as age advances, but size alone should not be an indication for operation. Rather, the rule should be that those causing symptoms should come out. No injury to the voice follows the removal of these glands despite the prevalent idea that such is the case. Attacks of tonsillitis and return of the tonsil are both possible after a tonsillotomy, though not probable. Post-operative hæmorrhage is not the factor in children that it is in young adults.

Except in a certain few cases of very young children or in those old enough to be rational, it is best to administer a general anæsthetic. If the tonsils and adenoids are to be done at the same sitting the former should receive the first attention, otherwise the field of vision would be obscured by blood. The tonsil snare, though it does the work well, is not quite so well adapted for children as is the guillotine. A tonsillotome of either the Mackenzie or Matthew's variety serves every purpose.

THE OPERATION.—If using a general anæsthetic, insert a mouth gag and then free any adhesions of the tonsils to the pillars of the fauces using a right angled hook for the separation. Matthews has found that by the use of the finger the dissecting can be made more complete; in fact, oftentimes the entire gland can be enucleated without the use of an instrument. This method may prove to be the ideal one. Usually, however, after the adhesions are sufficiently broken up the tonsil is engaged in the guillotine by the sense of touch; the shaft is brought well over to the opposite angle of the mouth, and with pressure along the shaft, to include the whole gland,

the knife is driven home. By a quick turn of the wrist at the completion of the stroke, the mass is brought away with the instrument. Changing the gag to the opposite side the process is repeated if both tonsils require removal.

It facilitates the work to begin with the smaller or more difficult tonsil.

After the tonsillotomy operation the adenoids are removed in the manner previously described. The bleeding stops after a few moments, but if it should persist, an application of hydrogen dioxide will usually suffice; a saturated mixture of tannin in water is also an excellent hæmostatic. Should neither of these remedies control it use a long uterine artery clamp over the bleeding spot.

FIG. 38.—Mackenzie's tonsillitome.

The after-treatment is rest in bed for a day and a fluid diet. A mild antiseptic gargle and sucking pieces of ice if the throat is sore, are all that is necessary.

Inform the parents that a whitish slough appears over the site of the operation, which otherwise might be taken to be diphtheritic membrane.

In the course of a week healing is complete, and a marked improvement in the general health of the child takes place.

[At a meeting of the N. Y. Jahr Club, March 1, 1909, Dr. A. R. McMichael stated that he had accomplished complete reduction of hypertrophied tonsils by the use of fulguration.—ED.]

HÆMATOMA AND ABSCESS OF THE SEPTUM.

From traumatism on the nose a child may not infrequently suffer from complete nasal obstruction.

On looking into the nose a cherry-red object is seen in each nostril close to the orifice. At first glance one might consider it a case of nasal polypus, but closer examination with a probe shows that we are dealing with a swollen septum, filled with blood, or, if a few days have elapsed, with pus.

FIG. 39.—Abscess of septum.

TREATMENT.—Whatever the contents of the swelling, the treatment is incision and drainage.

First cocainize the mucous membrane over the tumor in one nostril, and then make a generous incision down to the lowest part of the swelling, evacuate the contents and irrigate or wipe out the wall of the cavity with some mild antiseptic solution. Inasmuch as the cartilage of the septum is developed from two plates, and the exudate lies between these, more force than is at first considered necessary, is needed, to gain entrance into the cavity.

Most kinds of packing work out very soon so that there is a

damming back of the secretion and a recurrence of the obstruction. One of the best means of drainage recommended is a small skein of horse hair knotted and passed up into the cavity. A few dressings usually suffice for healing, though some permanent thickening of the septum is likely to persist.

FOREIGN BODIES IN THE RESPIRATORY TRACT.

Nose.—We should expect a little child to put all sorts of things in his nose by way of experimentation, and this we frequently do find to be the case. Buttons, beads, beans, seeds, leaves, grass, cotton, pieces of sticks, in fact, an endless variety of objects are concealed in the nasal orifices by children.

The substance may be lodged in the vestibule of the nose where it can be easily seen and extracted, or it may lie further in and not be detected without the aid of a head light and speculum, though there may be symptoms of pain and obstruction in one nostril.

On the other hand, there may be nothing to attract attention till a discharge appears on one side, which may have a foul odor. If not readily made out on account of fright on the part of the child and the liability of doing damage to such delicate structures by the necessary manipulation, it is wisest to administer a general anæsthetic, and then carefully examine the nasal passages by sight.

If a foreign body is discovered any instrument adapted to its size, shape and hardness should be tried. Often a probe with its tip bent to a right angle and passed beyond the object and then brought forward will answer. A small artery clamp may be useful, or better, a pair of nasal forceps.

However, if the substance is hard and impacted a mouse-toothed forceps is the best instrument, for considerable traction can be exerted with this without fear of injury to the parts.

Depending on the length of time the foreign body has been retained, there will be swelling, granulation tissue and ulceration, often accompanied by a sanguino-purulent discharge. The nose should, therefore, be sprayed out with a mild antiseptic solution, and this be continued for several days, varying in frequency with the infection or the amount of damage done to the structures.

FOREIGN BODIES IN THE LARYNY TRACHEA AND BRONCHUS.

The usual history, if one is obtainable at all, is that the child had something in the mouth, and then by a forcible or sudden inspiration like that preceding a cough or laughter the object was drawn down into the larynx. The offending substance may be large like a piece of meat, and become engaged in the laryngo-pharynx accompanied by extreme cyanosis, cough, spasm and death in a few moments from asphyxiation. If smaller, like a bread crumb or fish bone, the substance may lodge in a pyriform sinus, one of the pockets at the side of the superior laryngeal orifice; here the symptoms will not be so severe.

At other times an object like a coin, or pin, or seed will lie across the cords, or become fast in the ventricle between the false and true vocal bands, attended at first by severe spasm and coughing. By a deeper inspiration or by injudicious management the object may be drawn down below the vocal cords. At each paroxysm of coughing in the attempt to expel the body the vocal bands may close from spasm and so prevent its ejection.

If the article is small enough it may pass into a brouchus, usually the right, as the orifice of that side lies beyond the median line. Soon the object becomes fixed at some spot along the lumen of the bronchus.

At first a foreign body in the lower respiratory tract may cause but few symptoms, perhaps only some cough and localized spasm.

In a short time, however, owing to swelling and congestion there is dullness and absence of breathing over that portion of the lung to which the bronchus is distributed, brought about by collapse of the area of pulmonary tissue from absorption of the residual air, while later, from infection, we are confronted with a pneumonia or abscess of the lung in the majority of cases, so that removal must be attempted without delay to avoid these complications.

DIAGNOSIS.—Either the laryngoscope, autoscope or bronchoscope may locate the offending body. Likewise the fluoroscope may give us valuable information, both as to the situation and character of the object.

A careful physical examination should not be neglected.

TREATMENT.—A large substance, such as a piece of meat in the laryngo-pharynx, may be removed by sweeping a finger over the epiglottis, and so hooking the object out, or, if it is in the cavity of the larynx, inversion and slapping the patient on the back may cause its expulsion.

If these methods are unsuccessful and suffocation is imminent, tracheotomy must be done without delay; in the absence of other instruments, using a pen-knife for the incision and a hair-pin for the retractors.

On the other hand, if the coughing and spasm subside somewhat a laryngeal forceps may be tried, first cocainizing the interior of the larynx with a ten per cent. solution. This method is possible in but very few children.

Another method, if the object is known to be in the larynx, is to give a general anæsthetic and make an opening through the crico-thyroid membrane, and then with a wire or pair of forceps to seize the foreign body. Often, if in the trachea, the object will appear in the wound where it can be removed.

Until the work of Killian, the treatment of foreign bodies in the deeper parts of the respiratory tract was fraught with the greatest risk. But by the use of the instruments devised by him and perfected by his assistants and enthusiastic followers in this country, many successful results have been reported.

For bodies in the larynx itself the autoscope is very useful, particularly in children, as it gives a direct view of the interior.

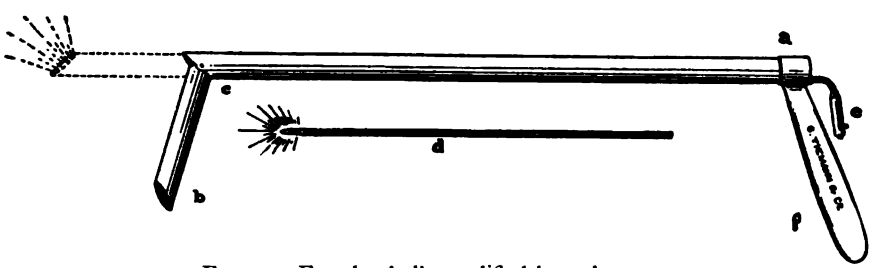


FIG. 40.—Freudenthal's modified bronchoscope.

For bodies in the trachea and bronchi longer tubes are required, varying in length and diameter, according to the size of the child.

In order to reach a branch of a bronchus a smaller tube is passed through a larger, telescopic fashion. These tubes are fenestrated near their tips, otherwise the air from the opposite bronchus would be entirely shut off.

For illumination, either an electric head mirror or a small electric light near the tip, if the tube is used.

As mucus collects in sufficient quantities to obscure the view at the bottom of the tube, a rubber suction pump with a long pipe attached has been devised to remove the secretion.

Very complete anæsthesia must be induced and cocaine solution applied to the mucous membrane just in advance of the tube in order to prevent coughing.

Various instruments for extraction are used, depending on the consistency of the foreign body and its position in the respiratory tract. Magnetic extraction has been recently tried with success.

Instruments similar to those used in bronchoscopy are of practical utility in œsophageal work.

ACUTE CATARRHAL OTITIS MEDIA.

All cases of earache in young children have as a cause some grade of inflammation in the middle ear. The mild form is more properly a catarrhal process, while the severer type is due to microbic invasion, and is accompanied by pus in the cavity of the tympanum.

A frequent kind of earache is one that comes on suddenly, as a part of a general cold, or an acute inflammation of the naso-pharynx in an adenoid case.

The child may complain only of a fullness or discomfort in the ear, or there may be an intense pain, which, however, may cease in a short time, the child meanwhile playing around absolutely unconscious of any discomfort, only to be as suddenly seized with the pain again. In no way does he seem to be ill, particularly no fever and only the irritability due to the attacks of pain.

This condition is due to a plugging of the Eustachian tube by mucus from coughing. The Eustachian tubes are relatively of large diameter and short in children. If this mucus plug remains longer than a few hours, the pain will be more constant. As the air in the middle ear is absorbed the drum is driven inward by atmospheric pressure.

Symptoms of this condition of retracted drum-membrane will be deafness and attacks of dizziness and tinnitis, the latter being due to pressure of the ossicular chain against the foramen ovale, thereby effecting the fluid in the semicircular canals.

In a day or two the partial vacuum in the tympanic cavity may be replaced by a congestion of the mucous membrane and an exudation of muco-serous fluid with consequent bulging of tympanic membrane.

EXAMINATION.—At first the membrana-tympani may show no change at all, or there may be a slight redness along the malleus, or at the periphery of the drum. Soon, however, there will be retraction of the membrane shown by an alteration or disappearance of the cone of light, the long arm of the malleus will appear shortened, while the short process will stand out more prominently. As explained above, instead of a retracted drum, from a gradual filling up of the tympanic cavity with serous fluid, we may see a bulging membrane, and if the membrane is not thickened we may even detect the height of the fluid.

PROGNOSIS.—These cases are not dangerous to life, but the condition is likely to return, and if persistent, to be followed by thickening of the drum-membrane, anchylosis of the ossicular chain and deafness, the chronic catarrhal form of otitis media.

TREATMENT.—The general indication for treatment is to correct the primary condition, whether adenoids, naso-pharyngitis or any other underlying cause; to keep the child indoors or even in bed, light diet and such constitutional treatment as occasion demands.

Locally, to use mild sprays and the application of adrenalin, 1-4,000, to the Eustachian orifices, in order to restore, if possible, the patency of the tubes, and also the employment of

Politzerization for the same purpose. The latter is not difficult in a child, for his very crying shuts off the naso-pharynx from the mouth and pharynx.

For allaying the pain ear, drops of 2 per cent. creolin in glycerine is often of service. The best way to use the drops is to dip a clean spoon in boiling water to heat it, then a few drops are put in the spoon and quickly poured into the external auditory canal, massaging the front of the ear at the same time. These drops can be repeated every two hours. The warm mixture may be applied on cotton.

Where one ear only has been involved, or where repeated attacks have thickened the drum membrane, catheterization must be resorted to. If resolution does not take place in a month's time these cases had better be referred to the aural surgeon for further treatment to prevent, if possible, chronic changes in the ear and Eustachian tube.

ACUTE SUPPURATIVE MIDDLE EAR DISEASE.

DEFINITION.—This is a true infective process, due to some form of micro-organism; it tends to run a definite course, with rupture of the tympanic membrane, and spontaneous recovery. There is not the liability of recurrence that is found in acute catarrh, but complications of serious importance frequently arise.

ETIOLOGY.—Since this form of otitis media is due to the presence of the germs of inflammation in the middle ear, the severity of a given case depends largely on the virulence of the kind present. At the time of a paracentesis it is possible to get a pure culture, and the report of the bacteriologist will be of

assistance to us, perhaps, in our dealing with any complications that may arise.

In children the most frequent causes are adenoids, diseased tonsils, "a cold in the head," acute infectious diseases, especially scarlatina, measles, whooping cough and influenza. Middle ear and mastoid conditions have been exceedingly prevalent in some grippe epidemics.

SYMPTOMS AND COURSE.—The attack usually comes on with increasingly severe pain in one or both ears, accompanied by fever and deafness. However, there is a great deal of irregularity in the symptoms. Infants may not have enough pain to call attention to the ear, and a discharge from the meatus or a stain found on the pillow may be the first sign we may have of the real condition of affairs.

Again, a child may be exceedingly restless for a night or two, teasing and crying out in his sleep and boring his head in the pillow. Another child will have marked meningeal symptoms. On the other hand, we may have only a very high temperature and a child that seems very ill. The aural speculum and a good light will help us in some of the vague cases.

The course of the disease is rapid. First a fulness in the ear is complained of, soon a pain which becomes throbbing in character, perhaps accompanied by tinnitus and vertigo. In a short time, either measured in hours or days, the drum gives way at its weakest part, and a discharge appears at the external meatus with a rapid amelioration of all symptoms, if the disease is to end favorably. In about two weeks the discharge ceases, and in a few weeks more the hearing is normal.

EXAMINATION.—There is often some pain on pulling the ear, and quite frequently some pain over the mastoid, especially at the tip. Politzer maintains that the pneumatic mastoid cells are always involved in a case of acute purulent otitis media.

However, in a favorable case we should expect this tenderness to rapidly subside after perforation, so we should not consider this symptom to mean mastoiditis.

The aural examination may first show congested vessels along the handle of the malleus and at the circumference. The entire membrane becomes red and then darker in color, especially in the upper part, Shrapnell's membrane. The intensity of the inflammatory process may cause blebs to form near the short arm of the malleus, and there may be an accompanying acute inflammation of the inner part of the external auditory canal. Bulging and perforation take place, as a rule, in the upper posterior quadrant. Perforation is known to have taken place from the discharge, bubbling and whistling sounds when the patient tries a Valsalva's inflation, and sometimes by seeing the perforation after cleansing the canal.

PROGNOSIS.—The outcome is always a doubtful one, but good drainage is the one great desideratum. In ordinary cases there is complete restoration in about six weeks, though some neuralgic pain and deafness may be complained of for a longer time. The types that follow infectious diseases are more unfavorable.

TREATMENT.—In the early stages before perforation or much bulging have taken place, certain palliative measures may be tried, as mentioned under the catarrhal form, but do not mask symptoms by giving too large a dose of anodyne. Ear drops of

℞.	Cocaine hydrochlorate	gr. xx.
	Ol. eucalyptus	m. v.
	Sol, majendie	ʒj.
	Sweet almond oil	q. s. ad. ℥j.

have been found useful.

A compress of a solution of dilute subacetate of lead and a

wick of the same in the canal certainly imparts a great deal of comfort. It is not advisable to syringe the ear before perforation, as it increases the congestion and renders the canal boggy.

The indications for paracentesis are:

(*a*) A bulging membrane, especially if it is in the upper posterior quadrant.

(*b*) If there is the least evidence of a sagging upper posterior external canal close to the tympanic membrane immediate incision is imperative.

(*c*) If from the color the tympanic cavity appears to contain pus.

(*d*) In small children where, though not much pain is complained of, the process looks active.

FIG. 41.—Line of incision in paracentesis of left membrana-tympani.

(*c*) Where cerebral symptoms are present.

(*f*) Intense pain.

(*g*) Tenderness over the mastoid region.

(*h*) Insufficient drainage in a case already perforated.

METHOD OF PERFORMING PARACENTESIS.—Wash out the canal with a 1-5,000 bichloride solution, preferably a half hour previous to the operation. The pain is so sharp and movement on the part of the patient so interferes with the work that a general anæsthetic should be given. A few whiffs of chloroform or ethyl chloride are the most satisfactory.

With the child lying in bed and with a good head light, a

speculum should be inserted deep in so that a good view of the drumhead can be had. Then taking a small bistoury begin an incision in the posterior lower quadrant, half way between the periphery and the tip of the malleus and a little below, carrying it upward to the periphery and into the tissue of the upper posterior wall of the external canal. This latter procedure depletes this congested region and so may forestall mastoiditis. Incise the membrane completely, but do not injure the internal wall of the tympanum. Wipe out the blood and pus, and insert a light piece of cotton in the canal. The canal can now be irrigated every two hours with warm boric acid solution, wiping away any discharge and reinserting a cotton wick as often as it becomes saturated. Sometimes more rapid results are obtained by using the dry method; cleaning out the canal with a cotton tipped probe till dry and replacing wick. Watch the temperature, pulse and mastoid tenderness, and the character and amount of discharge. If the symptoms, one by one, clear up, all is going well, but if such is not the case look for complications as discussed under acute mastoid disease.

Inflation can be used after all the acute symptoms have subsided. If it causes pain wait a longer time before again attempting it. If the patient has adenoids these should be removed when he is entirely convalescent from the ear condition.

ACUTE MASTOIDITIS.

It will simplify the subject of acute mastoid disease to discuss for a moment the surgical anatomy of this region, particularly as seen in children.

Connected with the tympanic cavity by a short passage-way called the aditus is the antrum, the largest pneumatic cell of the

mastoid bone. It lies behind the tympanum, its upper boundary being a few lines above this, while its lower boundary is on a level with the middle of the external auditory canal. This cavity exists at birth; the other mastoid cells develop around this except in front and internal to it, and are connected with this parent space. At about the fourth year the mastoid bone

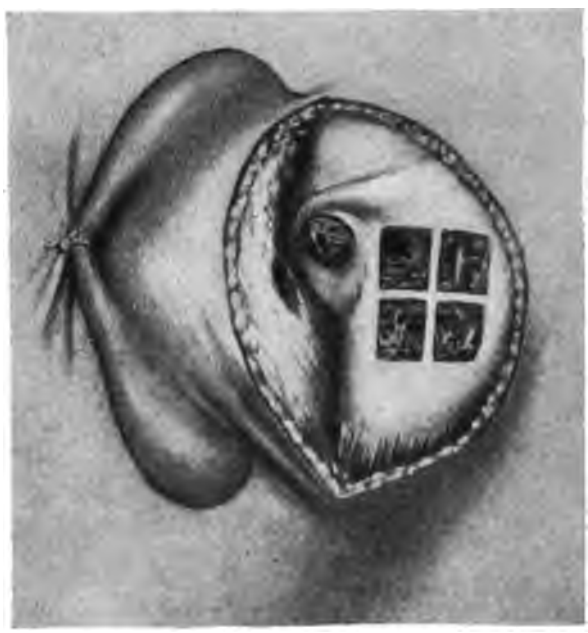


FIG. 42.—Division of mastoid processes into four equal parts. An opening in the upper anterior quadrant reaches the mastoid antrum; into the upper posterior quadrant reaches the lateral sinus; the lower anterior quadrant into mastoid cells; a superficial opening into the lower posterior quadrant reaches mastoid cells; a deep opening reaches the descending limb of the lateral sinus. (A. E. Schmitt.)

nearly resembles its adult form. In infancy the antrum lies superficial. The squamo-mastoid fissure at this time also runs down to the inner aspect of the antral space. Likewise there is a fissure separating the mastoid from the tympanic ring. It can be, therefore, readily understood how more avenues of infection are open in infants than in adults.

Glancing at a dried specimen of a temporal bone there will be seen at the upper and posterior margin of the external meatus a rough protuberance, the supra-meatal spine. This however, is not a constant development. The lucid picture given here shows the relationship of cells, antrum and sinus. The upper anterior square is made two-fifths of an inch posterior to the spine and just below the posterior root of the zygoma in the adult. Remember that quite frequently the lateral sinus may be found much further forward than is represented here.

As mastoid disease is but a complication of middle ear disease the primary causes are the same, the infection spreading by continuity. Imperfect drainage and recumbent posture are important factors in its production.

The symptoms are those of an otitis that has been going on for two or three weeks, but has not behaved satisfactorily since perforation. The patient looks tired and suffering, there is increasing pain over the mastoid or extending up over the head or to the occiput, often of neuralgic character, general malaise and perhaps some temperature. The latter sign is not to be trusted, for a most distinctive mastoid condition can take place with no fever at all.

Other classes of cases are more urgent, even fulminating in type, like an appendicitis with rapid involvement of peritoneum, depending upon the virulence of infection. Here we may have high fever, delirium, headache and other evidences of systemic poisoning, and certain local irritative signs, which are but the prodromata, may be of further brain or sinus complication, provided surgical means are not immediately used.

Prognosis.—As previously stated, a number of cases of acute otitis media have tenderness over the mastoid but without

destruction of deeper structures like muco-periosteum and bone. Unquestionably many of these cases recover without a mastoid operation.

Real mastoid disease, however, if let alone leads to permanent changes in the bone, or to complications with the gravest outlook.

TREATMENT.—Incipient cases are to be treated as under the heading for acute inflammatory otitis media. A generous incision in the drumhead, a good cathartic and a mild anodyne, also an ice bag or Leiter's coil over the mastoid, the use of leeches or cupping. Postural treatment, that is, with the patient lying well over on the face, and irrigation through the incised tympanic membrane have both been tried with some success, but in little children these methods would hardly apply for obvious reasons.

INDICATIONS FOR OPERATION.—The two chief indications for operative procedure are increasing tenderness over the mastoid and a sagging of the posterior superior wall of the external auditory canal near its junction with the drum-membrane.

A tenderness that gradually advances from a point just behind the ear attachment down toward the mastoid tip is of serious portent.

If a discharge has kept up for four weeks, and from its very profuseness indicates that it could not come from the middle ear alone, or if a discharge has suddenly ceased, together with certain unfavorable signs like increased pain, tenderness, somnolence and fever, all would point to immediate surgical interference.

Displacement of the ear forwards and outwards especially with some œdema over the mastoid bone indicates unquestionable involvement. Fever or rather the absence of fever is too uncertain a guide.

A differential blood count in mastoid disease is only corroborative as an indication for operation.

In fact, it is a composite picture of each individual case that must decide the question for the surgeon, and it is a condition that does not permit long delay in deciding for or against operation. A few hours may present some serious complication that may make a favorable outcome most uncertain.

The earlier the operation is performed the less the pathological processes, the quicker the healing and the less likelihood of subsequent deafness.

The instruments necessary for an acute mastoid operation are: A strong scalpel, scissors, toothed forceps, a few artery clamps, a periosteal elevator, a medium and small sized chisel, likewise two gouges, a mallet, bone curettes and a small malleable probe.

METHOD OF OPERATION.—Shave the hair for two or three inches around the mastoid region, cleaned in the ordinary surgical way, not omitting the auditory canal. The ear is pulled forward, and with the scalpel an incision is made directly to the bone, beginning at the upper attachment of the auricle and extending in a curved direction to the tip of the mastoid. This incision runs about one-fourth of an inch behind the ear. The periosteum is now pushed back with an elevator, exposing the greater part of the mastoid. Any bleeding vessels are of course, clamped.

The antrum is the point of attack in all acute cases. So with a narrow chisel, after drawing the auricle well forward and locating the supra-meatal spine, at a point just behind this and below the posterior root of the zygoma, entrance is made into the bone. This primary opening through the cortex corresponds to the upper and anterior window of anatomical figure, No. 42, given above. The direction is now changed to run

slightly upward and forward, parallel to the external auditory canal. Frequent use must be made of the probe to locate the antrum and to guard against opening the middle fossa of the cranium. At from two-fifths to one-half inch depth the probe will be found to enter a cavity, which is the antrum. Feel lightly for the aditus in order not to displace the ossicles for-

FIG. 43.—Schwartze's operation, the simple opening of the antrum and mastoid.

1. Supra-meatal spine.
2. Aditus (in depth of wound) leading to tympanic cavity.
3. Posterior root of zygoma.
4. Antrum.
5. Mastoid cells.
6. Tip of mastoid with fibres of sterno-mastoid.
7. Posterior wall of external auditory canal.
8. Fibrous portion of external auditory canal not separated from the bony portion. (Hunter Tod.)

ward. The rest of the mastoid cells are exposed and all diseased areas chiselled and curetted away, especially those at the tip and at the zygoma. Rough spicules should be smoothed down and the entire bony excavation made to slope gently toward the antral cavity like a funnel. Next examine the ex-

ternal auditory canal, and see that the opening into the tympanic membrane is sufficiently large for drainage. If it is not use the bistoury. Irrigate through the mastoid wound and observe whether some of the solution does not make its exit through the meatus. Swelling in the aditus may prevent this for a time. The wound is now packed, and a light wick introduced into the auditory canal. Perhaps a suture or two at the upper extremity of the incision might hasten the repair, but complete closure of the wound and healing by organized blood clot is not to be considered in acute cases. The after-treatment is like that of any other surgical case.

Untoward consequences in the operation are injury to the facial nerve, opening into the middle fossa or lateral sinus, and injury to the external semi-circular canal, which lies in the internal wall of the aditus. Wounding of the facial nerve occurs when working too deeply in search of the antrum. Nine-sixteenths of an inch has been given as the extreme limit in depth to go in the adult, and that means proportionately less in childhood.

GOITRE.

The pathological enlargement of the thyroid gland, known as goitre, occurs in children. With young persons it may at first consist of a hyperæmic condition in which the gland is enlarged, and if allowed to persist may result in true follicular hypertrophy.

It is not a very common disease in this country, but it does occur, and at the present time I have two young girls in the same family who have goitre. No other members of the family are affected, and there is no known reason why these two should be.

The enlargement may be symmetrical, giving fulness to the anterior portion of the neck, but more frequently one side is larger than the other. The enlargement becomes particularly noticeable when the patient puts the head backward. It rises and falls with the thyroid cartilage in the act of swallowing, which is a diagnostic sign distinguishing it from enlargement of other cervical glands. Goitre may exist without disturbing symptoms in youthful subjects, although in the cases which I have observed, there has been acceleration of the pulse, and frequent symptoms of extreme nervousness. The disease may often be cured in the early stages, but if allowed to go unchecked the growth may attain large size.

In a young man of twenty-one on whom I operated each lobe was the size of a child's head. In another youth of eighteen one lobe was the size of a baby's head and solid, while the other side, which I removed two years later, consisted of a single large cyst.

"Goitre occurs endemically, epidemically and sporadically." (Eiselberg in von Bergmann and Bull's Surgery.)

While the etiology is not definitely known in all cases, it has been pretty well demonstrated that in some portions of Europe it results from drinking water from springs or rivers which take their origin in certain soils. Other causes are heredity and certain occupations which cause congestion of the head and

FIG. 44.—Goitre in young girl of fifteen.

neck. It may occur coincident with menstruation, and in some cases the gland enlarges at the menstrual period.

The internal treatment of goitre in young people consists in the administration of thyroid gland. The most convenient form is the dried preparation in tablets. The dose is five grains once daily, and gradually increasing the number of doses to three a day. Lycopus Virginica in tincture or in low dilu-

tion is also an excellent remedy. In three cases I have effected reduction of goitre by the use of the high frequency current. It should be applied two or three times a week, and a current sufficiently strong to produce a smart reddening of the skin

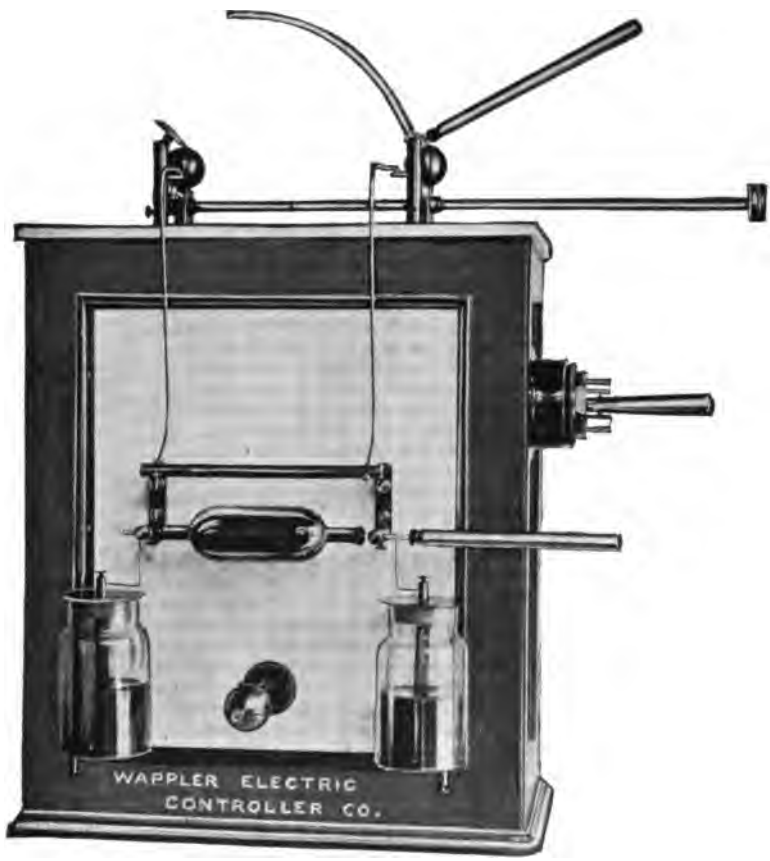


FIG. 45.—High frequency apparatus.

over the gland, but with care to avoid blistering. By an arrangement of the electrode, iodine may be driven into the gland.

It hardly seems necessary to consider the advisability of operating on children, especially in this country. Other meas-

ures, previously mentioned, should be given a thorough trial first.

For a description of the operations for goitre the reader is referred to the works on general surgery. Probably the technique of Kocher's operation is the more perfect, although it may have to be modified to suit special cases.

The conditions calling for operation are pressure symptoms or the appearance of symptoms of Graves's disease, while cosmetic reasons should be the last consideration.

The dangers of the operation are injury to the recurrent laryngeal nerve, and unexpected and violent hæmorrhage from the dilated thin walled vessels. In a case where I assisted the late Dr. F. E. Doughty, the patient narrowly escaped asphyxiation from unavoidable pressure on the trachea during the operation.

In no case should the entire gland be removed on account of the probability of myxœdema or tetany resulting.

Lately it has been shown that these symptoms followed the removal of the para-thyroid glandules. If these are left no bad symptoms are likely to follow.*

If such a condition should result the patient should be fed regularly on thyroid gland, either raw or slightly cooked, or, perhaps better, with some of the dried preparations now in the market. Division of the isthmus as an inhibitory measure is said to have given good results in some cases.

*Articles by Halstead, Evans and Pool.—Annals of Surgery, October, 1907.

THYMUS GLANDS.

Waldeyer and Sappey have demonstrated that there is present at birth what is known as the retro-sternal fatty body, which contains a considerable proportion of glandular elements. It lies between the innominate artery and the left common carotid, and reaches from the pericardium nearly to the thyroid gland (v. Eiselsberg in v. Bergmann-Bull).

This gland sometimes persists until adult life. Its function is unknown, but when it does persist it is sometimes the cause of sudden death; the children dying apparently of sudden suffocation, although previously in perfect health. This is probably due to hyperplasia and jamming of the gland between the upper edge of the sternum and the trachea.

Pressure of the gland on the pulmonary arteries is supposed to have caused œdema of the lungs, while pressure on the nerve trunks is credited with causing reflex spasm of the glottis.

What has been designated by Paltauf as the *"status thymicus"* is characterized by "persistence or hyperplasia of the thymus gland, enlargement of the lymphoid structures (lymph glands, tonsils, lymph follicles of the intestines, tongue and spleen), by a red medulla in the long hollow bones, smallness of the arterial system, dilatation of the heart and thinning of the blood. This *'status thymicus'* causes a diminution of the resisting power of the body, and many causes of sudden death may be traced to it." (Tillman's Text Book of Surgery, Vol. VII, p. 566.)

Many otherwise inexplainable deaths under anæsthetics are attributed to the *"status thymicus."* The presence of enlarged thymus gland may be suspected when a young person suffers

from chronic dyspnœa and there is no evidence of lung disease, but where stenosis of the trachea or large bronchi exists.

If a diagnosis can be made an operation may be performed for removal of the gland. "The thymus is exposed and dislocated (ectropexy) or the excess of the gland may be removed between ligatures." (Konig.)

Three successful cases are reported in Eiselsberg's article. (Surgery, v. Bergmann-Bull.)

ENLARGED LYMPHATIC GLANDS AND HODGKIN'S DISEASE.

Enlargement of the lymphatics may be either acute or chronic. When acute it is caused by some infection or local irritation, as acute exanthematous diseases, grippe, taking cold, unusual exercise, as, for instance, the so-called "kernels" in the groin which may come from skating when one has been unused to it.

Acute lymphadinitis may run a short course, lasting only for a few days, and may terminate in resolution or suppuration. Severe cases may be accompanied by fever, local swelling, redness, pain and great sensitiveness of the inflamed part to pressure.

Local application of the "C. and G." mixture or grated phytolacca root in a poultice, or the internal administration of merc. bi. jod. or merc. prot. iod. or phytolacca will usually cause a speedy recession of the disease. If not, and suppuration occurs, an abscess forms which will require opening. Where the abscess occurs in the axilla or about the large vessels of the neck, a small incision should be made just through the skin; work a director down through the tissues until pus shows in the

groove, then pass a narrow bladed pair of artery forceps along the groove, withdraw the director and spread the opening as much as desired. This is the safest method of opening an abscess in such localities.

Most of the chronically enlarged lymphatic glands that we see in children are tubercular. This is not always true, but it is the rule. Hodgkin's disease will be mentioned later.

Tubercular adenitis usually affects the cervical glands. It begins with a painless enlargement of the glands at the side of the neck, and without symptoms of inflammation early in the disease. Later the glands coalesce; they soften and the skin over them looks thin and dark red, and a "cold abscess" forms which later opens spontaneously upon the surface. The sinuses after spontaneous opening are deep and tortuous, and when they heal, depressed bluish scars are left, which are very unsightly. Often the deeper glands soften and break down before evidence of such a condition is indicated on the surface, and the surgeon is surprised to find tubercular pus where he expected to find only indurated glands.

As a rule, enlarged glands which persist and increase in size should be removed by operation, because if done early, the disease is of much shorter duration and the resulting scars much less noticeable. In removing enlarged glands from the neck an incision should be made a finger's width below the lower jaw and parallel with it, and *not* parallel with the sterno-cleido-mastoid muscle, as was once the rule. By making the incision as directed the resulting scar is in line with the wrinkles of the neck, and in later years is scarcely perceptible.

After incising the skin and platysma, they are drawn apart with retractors. The sterno-mastoid is pushed aside and the glands carefully enucleated. This is sometimes a tedious process, as care must be taken not to injure the deep vessels and

nerves. The most important vessel which is apt to be injured is the internal jugular vein, for the glands often cluster closely about it. If it should be nicked the cut should be closed with fine sutures. Of course, the carotids and the pneumogastric nerve should be carefully avoided. After removing all the glands the skin should be stitched with fine sutures, preferably

FIG. 46.—Enlarged lymphatic glands of the neck. The line shows the correct line of incision.

of horse hair, and wet bichloride dressing applied. This should be renewed daily until healing is well assured. If the precaution to apply wet dressings is neglected in such cases, infection and suppuration will be almost certain to follow.

When the case comes to the surgeon after suppuration is well advanced and fluctuation is marked, the whole mass of glands is probably broken down, and yet spontaneous opening has not occurred.

In such cases I have obtained a cure and avoided the scar of

an incision by drawing off the fluid and then injecting the cavity with etherial solution of iodoform in the same manner as described under the treatment of tubercular joints.

In other cases where the glands have partly broken down but not entirely liquefied and where sinuses already exist, incision curettage and packing with iodoform gauze has given good results. Of course, in all such cases careful attention should be paid to medication and nutrition.

HODGKIN'S DISEASE.

Hodgkin's disease occurs in children and is evidenced by the growth of masses of glands which at first are hard, separate, and when manipulated, slip on one another, giving the sensation which has been described like "balls in a net." The glands may be as large as plums, and the disease may show in the glands of the neck, axilla or groin; the deeper lying glands are also affected. At first they are hard and apparently a hypertrophic condition of the lymphatic tissue. While the general opinion is that the glands are tubercular, some authors hold that they are really lympho-sarcomatous and the tuberculosis accidental (Lazarus).

The disease may be slow in its development, but later the glands coalesce and form large masses which may limit the function of the respiratory apparatus. "The spleen is enlarged, the thyroid may be enlarged, anæmia is usually but not invariably present, and if it exists there are the ordinary symptoms which go with it, viz., palpitation, breathlessness, indigestion, vertigo, headache, pallor and sometimes epistaxis. Occasionally, without obvious reason, the glands suddenly increase in size, or rapidly undergo a notable temporary diminution. Slight fever exists at times in almost all cases, and ague-like paroxysms may occur. During the existence of fever

the glands usually increase rapidly in size. (Da Costa.) As a rule, the prognosis is bad.

The medical treatment consists largely in the administration of arsenic in the form of Fowler's solution. Hygienic treat-

FIG. 47.—Enlarged glands of the neck in Hodgkin's disease.

ment should be carefully attended to. If the glands are localized and the case comes under observation early the glands should be removed. I have done this on different occasions with good results.

OPERATIONS FOR LARYNGEAL STENOSIS

Since the introduction of the diphtheritic antitoxin operations on the larynx in cases of diphtheritic stenosis are far less

frequent than formerly, but there are cases which require either intubation or tracheotomy, and one should be familiar with the technique of both operations.

Regarding the indications for operative interference, especially intubation, Raue and Smith (Clinical Medicine, Bartlett) says: "Some writers recommend early intubation, while others believe that no interference should be instituted until the symptoms of laryngeal stenosis have progressed to a dangerous point. Personally, we believe that while there is no necessity for early intubation, especially where antitoxin can be freely administered, nevertheless we deplore putting off the operation until the child falls into a condition of dangerous collapse. So long as the child is able to cope with the obstructions, as shown by absence of cyanosis, carbonic acid poisoning and has a good periferal circulation, it is justifiable to wait and give medicinal measures full chance. Unquestionably, it is of advantage for the patient to go through the attack without mechanical (or operative) interference, for if we have once inserted a tube into the larynx, we can never be sure just when the child will be able to get along without it, and there is also danger of coughing up the tube and suffocating before help can be obtained."

The foregoing seems to me sound sense, and coincides with my own opinion.

INTUBATION.

Intubation of the larynx was introduced to the profession by O'Dwyer, and consists in introducing into the larynx tubes of metal or gutta percha, which are of sufficient calibre to allow of the passage of air to the lungs. These tubes are passed into the larynx by a specially designed instrument known as the "introducer," and are left in position as long as required.

For the introduction an anæsthetic is not generally required, although G. E. Brewer (Keen's Surgery) states that sudden collapse due to inhibition of cardiac and respiratory centres from irritation of the mucous membrane at the superior aperture of the larynx may be avoided by previously cocainization of the larynx or by Crile's method of hypodermic injection of atropin.

Most writers advise that the patient be securely held in the upright position, but Raue and Smith (Clinical Medicine, Bartlett) prefer the recumbent position on account of it being

FIG. 48.—Haslam-Ferrand intubation set.

easier to manage the child and also because in this position the soft palate falls away from the tongue. Whichever position is employed, the essential thing is to have the child under perfect control with the head so held that he can not move it, and the arms bound to the side.

The mouth gag is introduced as far back in the left side as possible, then the operator with the forefinger of his left hand passed down behind the epiglottis and hooking it up, feels for the arytenoid cartilage, then passing the tube along the finger

the latter is shifted backward towards the pharyngeal wall to prevent the tube slipping into the œsophagus. When the end of the tube is engaged in the larynx the handle of the introducer is raised quickly, and the tube pushed down into the larynx and released from the obturator by the slide on the introducer. An examination by the finger will determine whether the tube is in place, and, if not fully in the larynx, it should be driven home by the finger. A string which has been previously passed through the little hole in the rim of the tube will facilitate its removal, if necessary, on account of faulty position, plugging the larynx with dislodged membrane, or any other reason.

There is a divergence of opinion among writers as to the advisability of retaining the string attached to the tube while it is in the larynx. Some think it is a source of danger on account of the possibility of swallowing the string and dragging the tube from the larynx. Others retain it, allowing the ends to pass out of the side of the mouth and tying them at the back of the neck. If left for any length of time the child will chew it in two and the string will slip out of the tube. To obviate this Dr. Wm. H. Diehl, of Brooklyn, ties a knot near the tube on each side so that it is impossible for it to become dislodged. When it is required to remove the tube the end of the string can be caught in a pair of curved forceps and the tube drawn out.

In case the string is not retained, the tube is removed by a special instrument known as an "extractor."

Some uncertainty exists as to the exact time when the tube should be removed. From five to eight days' retention is sufficient in most cases, but when it is done the surgeon should remain with the patient for some time afterwards prepared to reintubate if necessary. Dr. Diehl has given as the result of

his observation in a considerable number of cases, that the tube should be allowed to remain until the mucus flows freely from the mouth and nose, that symptom being the indication that the proper time for the removal of the tube has arrived.

Feeding the child after intubation may be troublesome on account of the difficulty of swallowing. Raue and Smith (Clinical Medicine, Bartlett) recommend that the child be fed in Casselberry's recumbent position, or in extreme cases by gavage.

TRACHEOTOMY.

In children, the operation of tracheotomy is usually one of emergency, and is called for only in extremity. In diphtheria it is indicated where the child is in danger of asphyxiation from occlusion of the larynx by accumulated membrane which impedes the passage of air, and is required where intubation is impracticable. The operation may be easy of performance or one of great difficulty, depending on the condition of the patient, and the extreme haste which may be necessary to save the child's life.

Whether or not an anæsthetic shall be given depends entirely on the condition of the patient. If the urgency is not too great and there are no contra-indications ether may be given, and it may act as a heart stimulant. A few drops of chloroform or the injection of a one per cent. solution of cocaine are advocated by some surgeons (Fowler's Treatise on Surgery); (System of Practical Surgery, v. Bergmann-Bell, Vol. II, p. 55), but on account of their well known depressing action on the heart, I prefer ether, although it is objected to by some surgeons on account of the pulmonary irritation which it may cause.

If the patient's condition is too desperate, or the urgency too

great to admit of using ether, the operation had better be done quickly without it.

The late Dr. Clarence E. Beebe in one desperate case cut down through all the tissues and opened the trachea with a single stroke of the knife without an anæsthetic.

But with sufficient time ether or chloroform may be administered and the dissection made with some degree of deliberateness.

Given the conditions calling for the operation it may be carried out as follows:

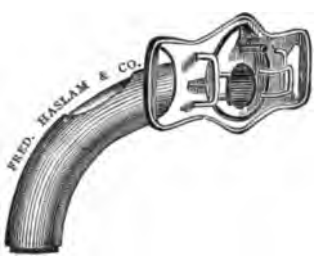


FIG. 49.—Trachea tube.

Place the child on its back in a good light with the shoulders raised and the head well back to make the trachea as prominent as possible.

One of the locations may be selected, either above or below the isthmus of the thyroid. The lower is preferable, as the lower opening is more likely to be free from membrane. The structures to be avoided in this location are the innominate vein and the thymus gland, both of which may rise above the notch of the sternum in small children.

In either location the incision should be made longitudinally in the median line. The muscles should be separated either with the knife or by dissection, and all bleeding stopped. If this is done with artery forceps they may be allowed to hang until after the trachea is opened.

When the trachea is exposed it should be opened with a small narrow bladed knife held back downward between the thumb and first and second fingers. The incision is made through the tracheal rings from below upward and from within outward, and in order to avoid wounding deeper parts, the hand holding the knife should be steadied with the tip of the third and fourth fingers resting on the chest. This, in case of sudden movement on the child's part, prevents the knife going deeper than is desired.

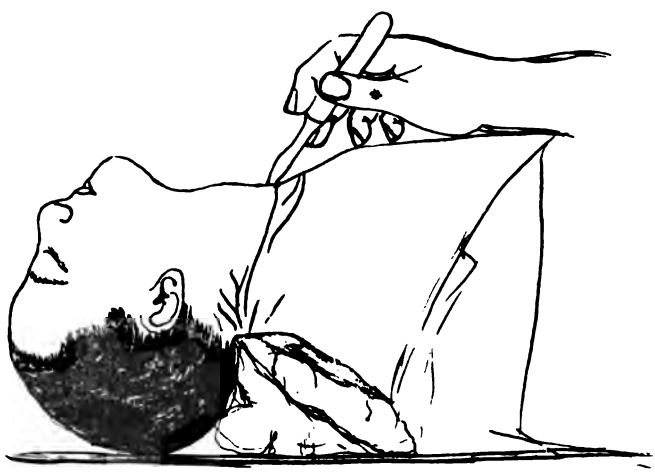


FIG. 50.—Correct method of holding knife while incising the tracheal rings. Edge upward.

Three of the trachaeal rings should be divided or even more is necessary. At the moment the trachea is opened there is usually a fit of coughing which causes a sudden expulsion of the tracheal contents. This is the moment of danger for the surgeon, who should always wear glasses, and have his mouth and nose protected, for the infectious matter may be thrown into his eyes or mouth if he is incautious.

On one occasion diphtheritic matter was coughed into the eyes of the writer, but the prompt application of an antiseptic solution prevented any bad results following.

When the rings have been incised, the slit should be held open by some sort of spreader. An ordinary pair of artery forceps with narrow blades will do. The tube is then inserted carefully and the tapes tied around the neck to keep it in place.

In order to avoid re-infection of the cut surfaces of the wound it is advised to apply an iodoform paste to them before opening the trachea. (v. Bergmann-Bull.)

The after-treatment consists in keeping the tube clear. For this purpose it may be necessary to remove the inner tube from time to time, or to suck out the obstructing matter with a syringe made for the purpose. *Never by mouth.* Several deaths of surgeons who have bravely but foolishly attempted to suck out the deposit by mouth have occurred.

The atmosphere of the room occupied by the patient should be kept moist and warm, at a temperature of at least eighty degrees, and a piece of gauze thrown loosely over the child's neck to prevent any particles of dust getting into the tube. After the expulsion of the membrane and where the patient has been able to breathe through the fenestrum of the tube for several hours with its external opening closed the tube may be removed.

During convalescence, while the tube is still in place, the child should be constantly watched, for the tube may become accidentally displaced and emphysema or asphyxiation ensue. Of course, from the nature of the case it is impossible to secure asepsis and primary union of the wound with sutures, and for that reason gentle coaptation of the edges with adhesive straps will be more serviceable.

DENTAL SURGERY.

BY GEORGE E. RICE, D. M. D.

INFANCY TO ADOLESCENCE.

Eruption.

In pathological dentition lancing the gums is a valuable aid to the eruption of teeth.

Gum tissue in its normal condition is comparatively insensitive, but when irritated it is exceedingly tender.

The greatest disturbance, however, is not found in the overlying gum tissue, but when a tooth is prevented erupting by the dense tissue over it there is a pressure on the formative organ below which causes reflex disorders often of a serious nature.

The tissue over the erupting teeth may or may not be inflamed. The absence of local inflammation does not necessarily contra-indicate lancing. Some of the gravest systemic disturbances occur where no local manifestations are evident.

The disturbance of the general condition from pathological dentition will depend, as in trouble due to any other disturbing cause, upon the temperament and health of the child.

In some cases there is a development of biliary, gastric, enteric and cerebral complications; a loss of vital power. In other cases the indications of disturbance of function are manifested primarily in the nervous system; the symptoms are all characteristic of acute derangement, and are dangerous from their violence and uncontrollability. High fever, vomiting, choleraic diarrhœa, meningitis, convulsions, stupor and death are the rapidly succeeding phenomena.

The objection to lancing the gums has been urged that in

case the tooth does not erupt immediately cicatricial tissue is formed over it which will bind the tooth down more rigidly than before. Cicatricial tissue is, however, of a lower degree of organization than normal tissue, and is more easily broken down.

The object of lancing is to divide the gum which holds down the tooth and permit it free egress. For the incisors a simple longitudinal incision is made. A little longer than the edge of the tooth for canines, and for molars a crucial incision is best.

In some cases the teeth are partially erupted, but a ring of dense gum tissue will be found around the point of the tooth which retard eruption, or bands of similar tissue may lie in the sulci of the tooth.

Deciduous Teeth.

The importance of the preservation of the temporary teeth is not generally recognized and cannot be too strongly urged. The general impression that these teeth are lost early and that it is unnecessary to pay much attention to their care and repair is the cause of serious trouble.

The incisors and cuspids are not of such material importance as the molars, which should be preserved for two reasons:

First. To prevent pain and allow the proper mastication of the food. The food is not thoroughly masticated where there are sensitive cavities in the temporary teeth. In the effort to escape the pain caused by the pressure of food on exposed nerves or its irritating effect on sensitive places, the child acquires the habit of bolting its food. Extensive caries results in the death of the pulp, which is followed by alveolar abscesses and teeth that are permanently sore.

Second. To prevent irregularity of the permanent teeth.

When the temporary molars are lost or decayed so as to decrease the diameter of the masticating surface it often results in a moving forward of the first permanent molars.

The most recent investigation of specialists in orthodontia demonstrates conclusively that a very large proportion of cases of irregularity of the permanent teeth depend on the malposition of the first permanent molars. To quote Dr. Angle, a recognized authority, "The mechanical influence of the deciduous teeth in the development of the dental arches is so important that they should not only be retained their full normal period, but if affected by caries their full mesio-distal diameter should be restored by suitable fillings."

In districts where dental services are not available valuable results may be obtained by the general practitioner by the application of nitrate of silver to carious places. The caries of teeth so treated being in many cases entirely arrested.

The pulverized nitrate of silver may be applied to the cavities with a small stick, or in places difficult of access, by using a flattened platinum wire bent to a suitable shape on which has been wound a wisp of absorbent cotton. The mouth should immediately afterwards be irrigated with salt water.

The nitrate of silver penetrates but a short distance and does not cause irritation. This method has been in general use about seventeen years, and valuable results have been obtained in schools where dental services were not attainable.

Odontalgia.

It is necessary to ascertain whether the pain is caused by an erupting tooth, a sensitive cavity, a nearly or quite exposed pulp, a putrescent pulp or an alveolar abscess. Pain during mastication may be caused by thermal changes, by pressure of food in the cavity, or by pressure on a tooth whose pericementum is inflamed.

The erupting tooth will be evidenced by the appearance of the gum.

Pain from a sensitive cavity or irritated nerve can usually be controlled by washing with bicarbonate of soda or by washing out the cavity with warm water and placing therein a pellet of cotton saturated with oil of cloves. Fletcher's carbolized resin:

℞. Carbolic acid, aa ʒj.
Resin (Colophony),
Chloroform, fʒss.

applied on cotton acts as an anodyne. The resin hardens in the cotton forming a temporary stopping that will even bear the force of mastication for several days.

If there is inflammation of the pericementum it is desirable to open into the pulp chamber. The decomposed pulp should be removed after the inflammation has subsided and the root canals filled.

If there is an alveolar abscess, open into the pulp chamber, wash out the contents as thoroughly as possible and apply hydrogen dioxide.

If a fistulous opening has formed through the alveolar plate but not through the gum an opening should be made by lancing.

Inflammatory Phenomena Due to Unerupted Third Molar.

Severe pain in the head, neck and face accompanied with swelling, œdema and high fever is often caused by an unerupted third molar.

In some cases the tooth is entirely below the gum, in others partially erupted. Usually the tooth is inclined forward so as to be held down by the adjoining tooth.

Immediate relief is given in many cases by cutting away the overlapping gum tissue which is often exceedingly tough and fibrous in nature.

If it is decided that extraction is necessary and the position of the tooth as related to the adjoining one is such as to make extraction difficult it is desirable to move the impacted tooth back into position by wedging, or if this is not practical the two adjoining teeth may be banded and a screw attached to this anchorage so that the third molar may be pushed backward and upward and the extraction of the teeth made possible without injury to the second molar.

DENTAL IRREGULARITIES.

Variations from the normal form of arch with mal-occlusion of the teeth are frequently observed. These abnormal conditions are rarely found with the deciduous teeth. A regular arch of the deciduous teeth does not, however, foretell a regular arch of the permanent teeth.

Etiology of Dental Irregularities.

The principal etiological factors of mal-occlusion are:

1st. Lack of development of the bones about the nasal cavity due to mouth breathing caused by adenoid vegetation, chronic enlargement of the faucial tonsil, irregularities, hypertrophies and cyst formations of the turbinal bones and occasionally polpi and benign neoplasmata.

Mouth breathing is found in a large percentage of all cases of dental irregularities, and is recognized as one of the most potent etiological factors.

The evil effects are always shown in the face. The nose is usually undeveloped with flattened alæ, cheeks pale, mouth

open, lower jaw poorly developed, weak receding chin with abnormal curve and thickness of lower lip, narrow arch in the upper with high vault and projecting incisors. The general effect on the facial expression is so pronounced as to be typical. (See photograph.)

FIG. 51.

Adenoids, or hypertrophy of the pharyngeal tonsil, a common cause of mouth breathing, is one of the commonest obstructive lesions of the upper air passages. It is distinctively a trouble of childhood, and is most active during the growth and development of the gums and teeth.

The evil effects of mouth breathing are so pronounced that

the importance of restoring normal nasal respiration is evident, and in order to retain this, the normal occlusion of the teeth must be also restored so that the active part of the lips, teeth and jaws in normal respiration may be secured.

2d. Heredity. The part that heredity plays in the etiology of mal-occlusion is a matter of debate. Some prominent orthodontists eliminate heredity as a possible factor, but the writer is unable to explain under any other hypothesis the peculiar malposition of an individual tooth found running through several generations, or the entire absence of individual teeth under similar conditions. A recent case is of interest in this respect, a peculiar protrusion of the lower jaw causing the lower teeth to bite outside the upper on one side, was noticed in one grandparent, a parent and two cousins. It hardly seems plausible to ascribe this to similar environment or the presence of some acquired cause.

3d. Delayed and injudicious extraction of the deciduous teeth.

When, as sometimes happens, the absorption of the roots of one or more of the deciduous teeth is delayed the succeeding tooth is either prevented from erupting or deflected into an abnormal position, very often causing mal-occlusion of a number of the permanent teeth.

The injudicious extraction of a deciduous tooth results frequently in the moving forward of the permanent six-year molar, and, as has been noted before, these teeth are practically the key to the arch as far as normal occlusion is concerned.

4th. Injudicious extraction of permanent teeth, particularly the first permanent molars.

It is a generally accepted tenet among orthodontists that the extraction of permanent teeth to obtain room for the regulation of teeth as practiced in the past was an unfortunate mis-

take. The results obtained when the patient reached adult life being a disappointment; the position that it is practicably never desirable to extract a permanent tooth is rapidly taking its place.

While the effect of expanding the arches and placing the teeth in proper occlusion does in many cases give the child an appearance of fulness about the mouth, and, to use a colloquialism, "too much teeth," it must be remembered that while the teeth are at this period of full size the bones of the face have not reached maturity, and when they do the normal proportions are found to exist and a satisfactory and pleasing facial contour is obtained.

5th. Delayed eruption of permanent teeth.

The troubles caused by the delayed eruption of permanent teeth are obvious. The X-ray is of very material assistance in the diagnosis of the condition present, and it is often desirable to assist the eruptive process by mechanical means.

6th. Thumb-sucking and similar habits.

The mal-formation caused by these habits is easily recognized at an early stage, and the correction of the habit allows the lips and tongue to correct the deformity often without mechanical assistance.

7th. Presence of supernumerary teeth.

8th. Abnormal frenum labium.

Abnormal frenum labium results in a separation of the central incisors. This is a decided disfigurement and often difficult to overcome.

Methods, Apparatus, Etc.

The skill and inventive faculty of the orthodontist in recent years has resulted in the development of an infinite number of

devices, generally using the elasticity of rubber, the spring of wire or bands or the principle of the jack-screw for the correction of the various malformations of the jaw and mal-occlusion of the teeth and the development of æsthetic facial contours.

FIG. 52.—Same case after correction.

The most desirable qualification of appliances used in the regulation of teeth and shaping of the jaws are simplicity and efficiency in combination with freedom from bulk.

The appliances in use at the present time use force in two ways—continuous and alternative.

Continuous pressure is obtained by using the spring of a metal wire or band, the elasticity of rubber, the expansion of wood or the contraction of a linen line.

Alternative pressure is obtained by the use of jack-screws to obtain pressure or a modified form of jack-screw generally known as a traction or drag screw to obtain a pulling force.

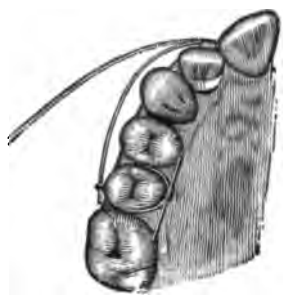


FIG. 53.

Retention.

There has been considerable dissatisfaction in the past on account of the failure of these operations; the teeth after the retaining appliances have been removed rapidly moving back to the former irregular position.

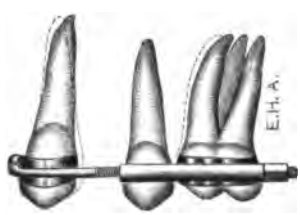


FIG. 54.

The recognition of the fact that every tooth must be retained to secure the best results and the absolute necessity of the proper relation of the six-year molars to one another has resulted in the accomplishment of consistent permanent results.

In the restoration of the normal dentition a very important part of the problem is the retention of this condition.

If a normal occlusion of the teeth is obtained and the teeth

are held in this position until the tissues surrounding them have developed to meet the function required by the new conditions the permanency of the operation will be secured.

Inconspicuous wire retaining appliances can be designed and fastened in the mouth in such a manner as not to interfere in any way with mastication, thorough cleansing or the comfort of the patient.

The time required for retention varies according to the age of the patient and the work that has been done. Some forms

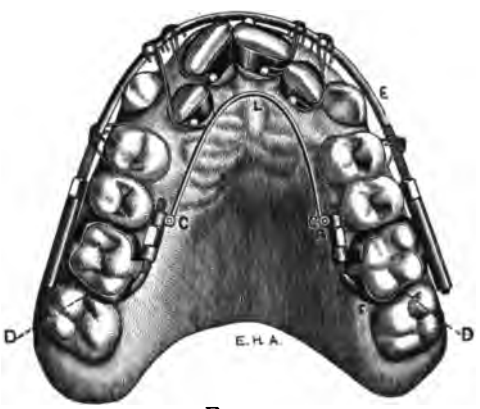


FIG. 55.

of irregularity when corrected are practically self-retaining on account of the occlusion of the teeth; others requiring two or more years before it is safe to dispense with the retaining appliance.

The two photographs show a typical case of poor facial development due to adenoids and the correction of same by the removal of the adenoid vegetation and the correction of the deformity after the beginning of the treatment.

The illustrations show typical forms of appliance used for the correction of mal-occlusion. (The illustrations are from "Mal-occlusion of the Teeth," Edward H. Angle. Seventh edition.)

PLEURISY WITH EFFUSION.

In those cases of pleurisy with effusion where the fluid is slow in being absorbed, or where, by its large amount, it causes pressure on the thoracic organs and dyspnœa, surgical treatment may be called for. In ordinary cases absorption takes place under medical treatment, but if it does not there is danger of infection and the formation of pus.

Removal of a portion of the serous effusion will not only give immediate relief but will stimulate absorption of the remaining portion. When required, aspiration should be done under the strictest antiseptic precautions. The fluid may be drawn off with an aspirating pump, or a simple apparatus consisting of a medium sized trocar and canula fitted tightly into

FIG. 56.—Emmet's trocar.

the end of a rubber tube. Or, better, an Emmet's trocar which does not allow air to enter the canula. The other end of the tube (three or four feet long) should lead down into a large glass bottle half filled with some antiseptic solution. The end of the tube may be weighted so that it rests on the bottom of the jar and always below the surface of the antiseptic solution. The needle is pushed between the ribs in the seventh or eighth intercostal space in the axillary line. The intra-thoracic pressure is sufficient to force out the fluid. When it ceases to flow the canula should be withdrawn, and as it slips from the skin a piece of sterilized Z. O. plaster should be quickly applied over the puncture. Whether or not a second operation will be re-

quired depends upon the reaccumulation of the fluid or the presence of empyæmia.

EMPYÆMA.

When pus forms in the pleura the condition becomes much more grave than that of pleurisy with serous effusion. In

FIG. 57.—Removal of fluid from pleura with Emmet's trocar. The trocar partly withdrawn from the canula allowing the fluid to pass off through the rubber tube.

occasional cases simple aspiration is sufficient to effect a cure, but they are so very infrequent that it is hardly worth while to attempt a cure by this method.

In case of empyæma it is necessary to maintain drainage after evacuating the pus until expansion of the lung or obliteration of the cavity has occurred.

In recent cases the operation is exceedingly simple.

The operation which I do has proved efficient in all recent cases, and is performed as follows, and can be done in a few minutes:

If the patient's condition permits, a general anæsthetic may be administered, and I have generally given it because it relieves the extreme nervousness in a child and allows of more deliberateness in manipulation. Where general anæsthesia is not admissible the skin may be frozen with ethel chloride at the point of puncture. To my mind cocaine should not be employed on account of the weakened condition of the heart. In one case where I did use it the patient went into collapse and was rescued with difficulty.

With a scalpel an incision an inch and one-half in length is made through the skin over the seventh or eighth inter-costal space in the axillary line. This incision extends down to but not through the muscles. A director is then pushed through the intervening tissues until pus flows out along the groove. Then, keeping the director in place, a pair of sharp-nosed artery forceps, or better, a small uterine dilator, is passed along the groove into the cavity, the director withdrawn, the blades of the dilator spread apart and the pus allowed to flow through the expanded opening. So far, I have never seen any sign of collapse with the open operation and evacuation of a large quantity of pus, and I have removed three quarts of pus from the left pleura of a child eight years of age at once, with no bad result. In this case the amount of fluid was so great that the heart was pushed clear over to the right side of the chest. The surgeon must determine in his own mind as to the advisability of washing out the cavity. I have never seen any bad result follow doing so, and have used bichloride of mercury solution, 1/2,000, or normal saline solution with equally good results, and now use the latter in preference.

The tube is then inserted through the wound and may be held in place by strips of adhesive plaster placed over safety pins as shown in the cut. The straps should be long enough to extend for some distance beyond the pins because the leakage at the side of the tube is apt to loosen them.

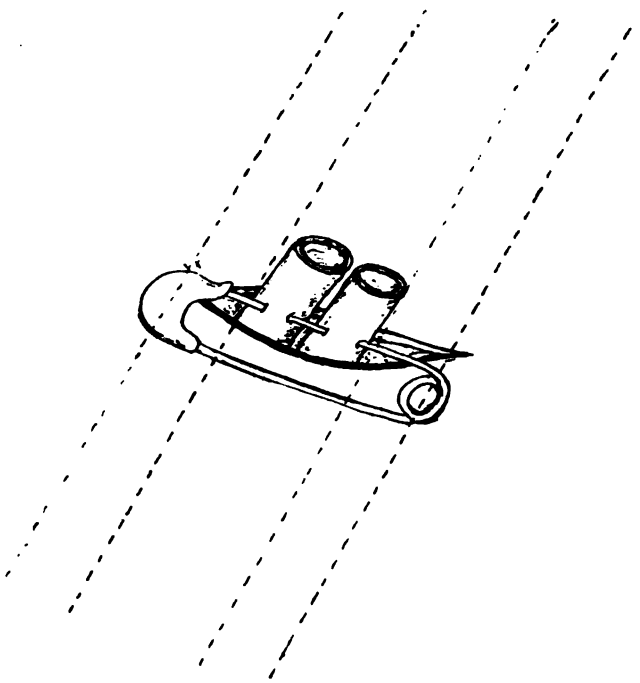


FIG. 58.—Author's method of retaining drainage tubes in the wound after operation for empyæma. Dotted lines represent strips of adhesive plaster passing over the safety pin to hold it in place.

Two tubes placed side by side are very useful as they allow of more easy irrigation in case it is required. Subsequent irrigation may be regulated by the condition of the patient as indicated by the temperature. If the temperature rises it is an indication of sapræmia, and washing of the cavity will generally bring the temperature down to normal.

The tubes should be watched. It may be necessary to re-

move and change them from time to time, and sometimes the removal of granulations is necessary to prevent premature closure.

Many surgeons advise the resection of a portion of a rib. The reasons advanced are that this is necessary to obtain sufficient space for drainage, and that the wound is more easily kept open with the portion of the rib removed.

From a considerable experience in the surgical treatment of empyæma I am thoroughly convinced that resection of a rib is, as a rule, quite unnecessary, and is, in fact, open to objection. I have never yet seen a case in a child where sufficient space could not be found between the ribs for the drainage tubes, and have found it quite as easy to keep the wound open as where the rib has been resected. On the other hand, I have had much more trouble with cases in which resection has been done, and healing has been greatly delayed. Interference with the rib leads to necrosis of the exposed ends of the bone, and restoration of the chest wall is not as perfect as where it is not done.

The cases requiring resection of the ribs are those which have existed for so long a time that the pleura has become thickened. The lung does not expand and the ribs hold the pleural surfaces apart so that there is little probability of the cavity filling by granulation. In such cases the removal of portions of three or four ribs will allow the chest wall to cave in to such an extent that the cavity is greatly diminished in size and healing is accelerated. Some cases may require the even more extensive operations of Schade or Estlander, but this would seldom be necessary in a child

In case, however, the surgeon in charge thinks it best to remove a section of one rib it may be quickly and easily accomplished. The only special care necessary is to avoid wounding

the intercostal arteries, which may be done by keeping close to the rib in raising the periosteum.

The operation may be done as follows: Under full anæsthesia an incision is made down to the rib and parallel to it in the axillary line. The periosteum is pushed away and a Gigli saw may be inserted under the rib and the bone sawn through from within outward. Then the saw may be again passed under the rib at another point, and whatever amount of bone is required removed. If a Gigli saw is not at hand the bone forceps may be used, or in small children a strong pair of scissors.

When the section of the rib has been removed, the opening into the pleura is easily made and the tubes placed as already described.

APPENDICITIS.

Children are frequently subject to attacks of appendicitis which are likely to be recurrent in character.

No age is free from the disease. I have operated on children as young as two years of age, and other surgeons have had cases much younger.

Many children suffer from periodical attacks of colic, which are usually attributed to indiscretions in eating. They also frequently complain of pain in the right side after severe exercise or running ("side ache"), which is passing in character, and little attention is paid to it. Probably in both cases the colic and "side ache" come from subacute appendicitis, which may become acute and terminate either by resolution or in abscess. In the latter case the abscess may be and usually is walled off from the general peritoneal cavity by exudation and

adhesions, and finally, if allowed to take its own course, will open spontaneously on the surface or into an intestine.

Where a child complains frequently of the symptoms mentioned in the preceding paragraph, it is well to keep it under observation, because, while such minor symptoms do not call for operation, still the knowledge of the character of the pains, and the fact that they occur at intervals, will aid materially in the diagnosis in case of a more serious attack. Also this knowledge may lead to proper medical and dietetic treatment tending to avert an acute attack.

In ordinary acute attacks there may or may not be a chill; fever is usually present, but not to a high degree. The pain at first may be referred to the epigastrium, but finally is located about "McBurney's point," a spot located about two inches from the right anterior superior spinous process of the ilium, on a line with the umbilicus. The sensitiveness is usually greatest on point pressure over this location. The right abdominal muscles are rigid and "board like," and the thigh flexed* on the abdomen to relax the tension of the ilio-psoas muscles on the inflamed point. Vomiting is usually present, also constipation. After a period varying from twenty-four to thirty-six hours, palpation and percussion will usually show the presence of a mass in the region of the appendix.

If, under treatment, resolution takes place, the symptoms begin to subside after two or three days; vomiting ceases, the temperature falls, and the rigid abdominal muscles relax. The mass diminishes and often disappears within ten days or two weeks, and normal function is resumed. The tenderness at McBurney's point usually persists for some time, even after all the other symptoms have disappeared.

*An exception occurred in three cases where the thigh was extended instead of being flexed on the trunk during an acute attack.

If instead of resolution taking place an abscess forms, the symptoms persist, the lump increases in size and fluctuation may be elicited. There are the usual symptoms of sepsis with chills, fever and sweats, especially the latter, and the symptoms keep up until the pus is removed either by spontaneous evacuation or operation.

In the cases known as "fulminating appendicitis," where the process is rapid, the appendix becomes gangrenous and ruptures into the abdomen before protective adhesions have time to form. In such cases the symptoms are those of shock followed by rapidly developing septic peritonitis. Only *immediate* operation can possibly save such a case.

The medical treatment of non-fulminating cases of appendicitis is comparatively simple. It consists in absolute quiet in bed, restriction of the diet to liquids, and the administration of such remedies as appear to be indicated. The most prominent among these are Bryonia and Mercurius dulcis. An enema may be called for in the early stage to relieve an overloaded bowel.

An ice bag over the seat of inflammation is indicated, and if a compress saturated with Creolin 2 per cent., Glycerine 98 per cent., is placed between the ice bag and the skin, it may give additional relief.

To my mind there are three periods when operative treatment is appropriate if not always imperatively indicated. During the first hours of an attack, before adhesions have formed and localized peritonitis has set in, an operation for removal of the appendix may properly be performed if necessary. This also applies where there is a possibility of rupture with consequent impending septic peritonitis. In other words, an operation in the early hours of an attack may be considered as a usually safe operation.

The second period is when an abscess has formed. As soon as this can be determined an opening should be made to evacuate the pus, and, if possible, to remove the remains of the appendix. In many cases the abscess can be opened at a point which is extra-peritoneal. This is done by making the incision close to the wing of the ilium and burrowing down close to the bone and separating the peritoneum from it until the pus is found. Then the opening into the abscess cavity may be dilated and the pus evacuated without the general peritoneal cavity being invaded. Afterwards the abscess cavity may be washed out with an aseptic solution. As a rule, I prefer the nomal saline solution for this purpose. Then large rubber drainage tubes and probably cigarette drains may be inserted. I usually prefer to use two rubber tubes to the cigarette drains. These are gradually shortened as the cavity fills up. I have found this method to be sufficient in many cases, and it is very safe, but, of course, the appendix if there is any portion of it left, is not removed. To attempt to do it at this time adds greatly to the danger of the operation, and it may be left to a later and safer time. I believe, however, that, as a rule, it is so thoroughly disintegrated that it passes off in the pus and is never heard from again.

The third period for operation for appendicitis is in the interval after an attack. If the patient appears to be doing well after the first twenty-four or forty-eight hours, if protective exudation and adhesions have formed, then it is better to wait until after the subsidence of the inflammation and absorption of the exudation before operating. Two or three weeks after the close of the attack is usually sufficient. If done too soon unabsorbed adhesions may give trouble, as in a recent case where on the ninth day I found the colon closely adherent to the parietal peritoneum.

The ordinary operation for removal of the appendix is done by making an incision from one and one-half to two and one-half inches in length over "McBurney's point" in the line of the fibers of the external oblique muscles. After dividing all the tissues down to the aponeurosis of this muscle its fibres are split or separated and drawn apart. The same is done with the internal oblique and transversalis, and the wound held open by blunt retractors. This will give sufficient room in an

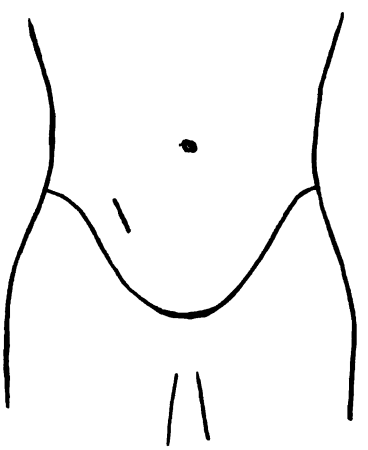


FIG. 59.—Line of incision for intra-muscular operation. (McBurney.)

ordinary case to manipulate the intestine and remove the appendix, while it lessens the liability to ventral hernia. But in case the opening proves too small it is better to enlarge it still more, than to subject the intestines to the traction necessitated by too small an opening.

After opening the peritoneum, the colon is recognized by the ribbon of fibers running longitudinally along its anterior surface. The ascending colon is drawn gently forward and each portion is returned to the abdomen after inspection. When the cæcum is reached the appendix may be found free or at-

tached to some portion of the intestine. Sometimes it is so buried in masses of new material as to be unrecognizable until it is dug out, but when the line of cleavage is found between the appendix and the gut, it is generally separated rapidly and

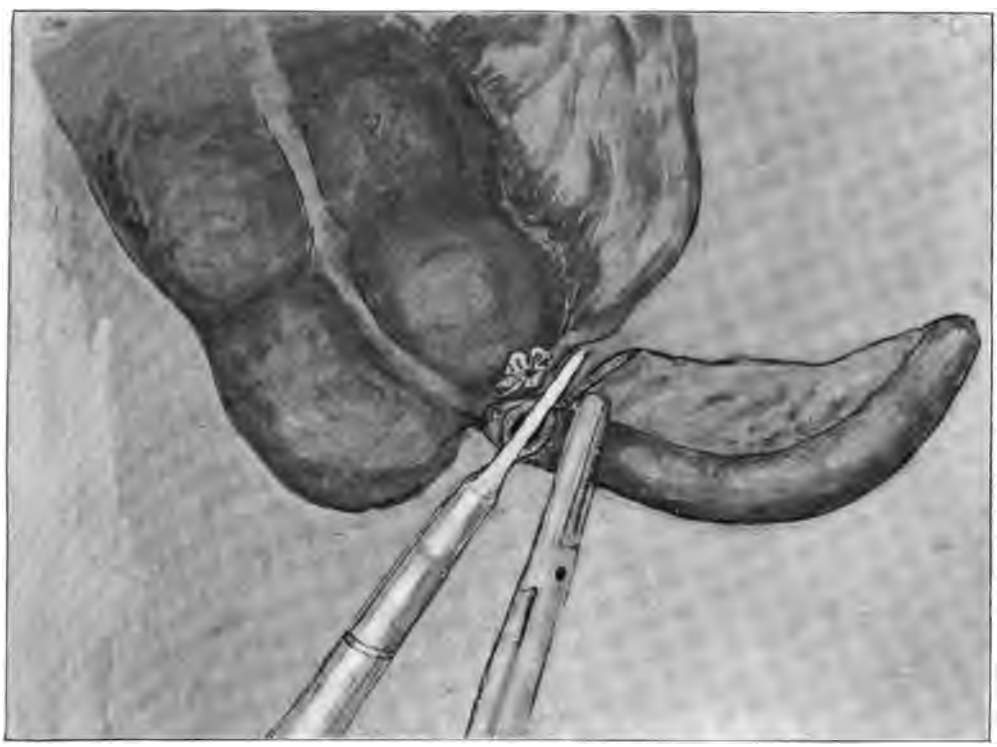


FIG. 60.—Burning off the appendix after ligation.

easily. Before removing the appendix, cover the gut with pads of gauze wet in saline solution.

There are several methods of removing the appendix and treating the stump, but I think the simplest and best way is to take a sharp nosed pair of artery forceps, pass them through the mesentery close to the base of the appendix, then opening the jaws slightly, grasp the loop of a double chromicized (ten

day) catgut and draw it back, cut the loop, tie one-half very tightly around the appendix and the other half about the meso-appendix. Then with a paquelin cautery burn through the appendix and the meso-appendix. It is well to char the stump of the appendix still more in order to render it quite aseptic before returning it to the abdomen.

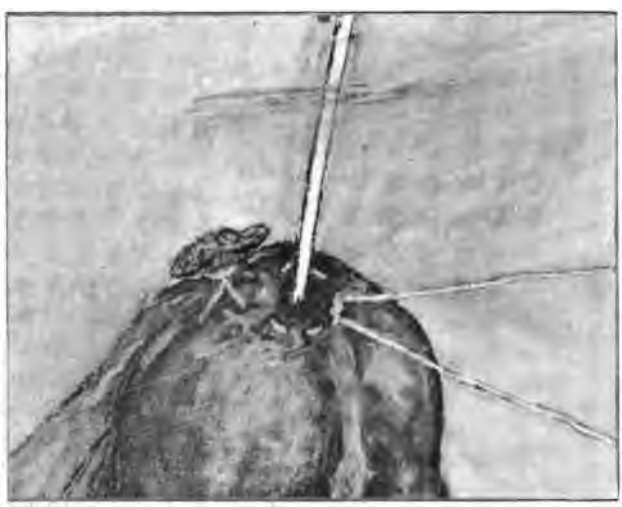


FIG. 61.—Inverting the stump of the appendix with the double probe as the purse string is being tightened, the meso-appendix having previously been tied off and removed.

I have employed this method with perfect satisfaction for several years. Formerly I used to invert the stump with a double pointed probe and then draw the peritoneal surfaces together with one or two purse string sutures, but this method has yielded no better results than the one first mentioned, while it requires more time and care; therefore, I have abandoned it except in certain cases where it is especially indicated.

The peritoneum should be stitched with a running suture of catgut, and the soft muscular fibers with a loosely drawn suture of the same. But care should be taken to unite the

FIG. 62.—Last step of closure of an abdominal wound. Application of narrow strips of adhesive plaster while wound is put on the stretch longitudinally.

fibrous aponeurosis of the external oblique with a long lasting suture of kangaroo tendon or chromicized gut. The reason for preferring an easily dissolved suture for the peritoneum and the soft muscular tissues is that they unite quickly, while on the other hand, tendinous structures unite slowly and require a longer lasting suture to retain them in apposition until the union is firmly established. It is in the integrity of this fibrous sheet that we depend largely for the prevention of ventral hernia. The skin and subcutaneous tissues may be approximated in whatever manner the operator prefers. My preference is for silk worm gut sutures, about three-quarters of an inch apart. Then across the wound in the intervals between the sutures are placed narrow strips of sterile Z. O. plaster, while the edges of the wound are placed in perfect approximation by putting it on the stretch.

In this method the sutures may be removed on the sixth or seventh day, while the plaster strips may be allowed to remain on as long as they will stick, to support the newly formed cicatrix and prevent its stretching.

APPENDICOSTOMY.

"Weir's Operation."

Appendicostomy was first designated by Dr. R. F. Weir, of New York, to obtain efficient irrigation and flushing of the colon in cases of ulcerative colitis. The abdomen is opened, the appendix drawn out and fastened to the skin with the tip projecting. After closing the wound the tip may be cut away and a probe passed down through to see if the appendix is patent in its whole length. Then it is ligated to prevent leakage, but this ligature is removed after a couple of days, and the

opening left on the surface. Acting on the theory that many cases of epilepsy arise from intestinal irritation, some surgeons have been performing this operation and employing the opening thus obtained for the purpose of washing out the colon and removing the irritating matter.

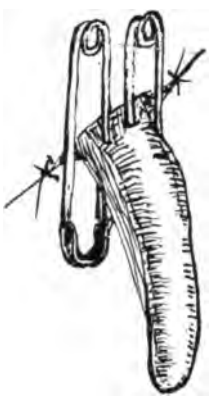


FIG. 63.—Bennett's method of fixing the appendix in position.

Hardly sufficient data has as yet been collected to warrant recommending the measure for cases of epilepsy.

Its proper function seems to be in cases where there is some form of ulcerative disease in the colon.

INTUSSUSCEPTION.

Intussusception is a condition in which one portion of the intestine slips down into the portion below and becomes invaginated. The portion which becomes invaginated is known as the *intussusceptum,* while the portion which encloses the *intussusceptum* is known as the *intussuscipiens.* There may be a second or even a third invagination of the intestine inside of the first.

There are four varieties of intussusception differing according to the portion of the intestine affected, and they occur

in frequency in the following order: Ileo-cæcal, 44 per cent.; enteric, 30 per cent.; colic, 18 per cent., and ileo-colic, 8 per cent. (Lichtenstern.)

Intussusception occurs more frequently in childhood during the first year, and mostly between the fourth and sixth months. Males are more frequently affected than females. It is supposed that the greater mobility of the colon, owing to its loose attachment to the iliac fossa, in children, accounts for the greater frequency of intussusception in infancy.

As a rule, the intussusceptum comes from above, and slips down into the portion of bowel below it. Very seldom the reverse takes place. In the paralytic variety the upper portion becomes paralyzed, and is drawn down into the lower by the peristaltic action of the lower: very much as a snake swallows a frog. In the spasmodic form the upper portion contracts and becomes cone-shaped and is forced into the lower portion. Inflammatory adhesions occur between the intussusceptum and the intussuscipiens after twenty-four or forty-eight hours. The intussusceptum becomes constricted, its mesentery is dragged upon, and the circulation becomes interfered with so that finally strangulation may occur with subsequent gangrene and sloughing, or perforation may result.

If death does not occur from peritonitis the sphacelated portion may be cast off and pass from the bowels either in shreds or in one mass, varying from a few inches to two or three yards in length.

If this occurs, union may take place between the two ends of the gut at the neck, which may eventually be followed by a stricture. Intussusception may result from gluttony and acute indigestion, or the presence of polypi, or malignant growths.

One case occurred in my experience where a very young child had been allowed to eat freely of green corn. Trauma

may be a cause. The practice of dancing the baby, severe and prolonged exercise, like rope jumping, etc., may cause intussusception.

Wiggin gives sex as a causative factor, seventy-five per cent. of the cases occurring in males.

Attacks of intussusception generally occur suddenly with agonizing pain, usually referred to the umbilical region. After a few hours the violence of the pain may subside, and the patient be *apparently* better until a second attack occurs. The pain is usually accompanied by nausea and vomiting, which may eventually become steroraceous. There is also tenesmus with bloody, jelly-like stools, and, later, peritonitis sets in. At first the temperature may be subnormal and the symptoms indicate severe shock. When the patient is examined early a tumor may be detected, which is cylindrical in shape, movable, and not necessarily sensitive. In some cases bi-manual examination is necessary with one finger in the rectum and the other hand on the abdomen. In some cases the surgeon may not be able to detect the tumor, and after peritonitis sets in and the bowels have become distended with gas it will be impossible.

The chief diagnostic signs are sudden attacks of agonizing, colicky pain, vomiting and symptoms of shock, bloody, jelly-like stools. Presence of cylindrical tumor (not always found). Later, peritonitis.

The attack will, in most cases, end fatally unless immediate and radical measures are instituted. Some cases where the patients survive the first shock and peritonitis, may end in sloughing of the *intussusceptum* with union of the ends of the gut, and finally recover. Other cases may occur without complete stoppage of the gut and a condition of chronic intussusception ensue.

If, on examination of a case, intussusception can be diag-

nosticated, active measures should be employed for its relief. If seen early, that is, prior to twelve hours from the beginning of the attack, hydrostatic replacement may be attempted. After twelve hours this method is dangerous. To carry out this form of treatment the child is inverted, the rectal tube of a fountain syringe is inserted into the rectum and the bag filled with saline solution is raised from four to six feet above the patient and the water allowed to flow. Six feet of head is considered the limit, while four or five is more conducive to

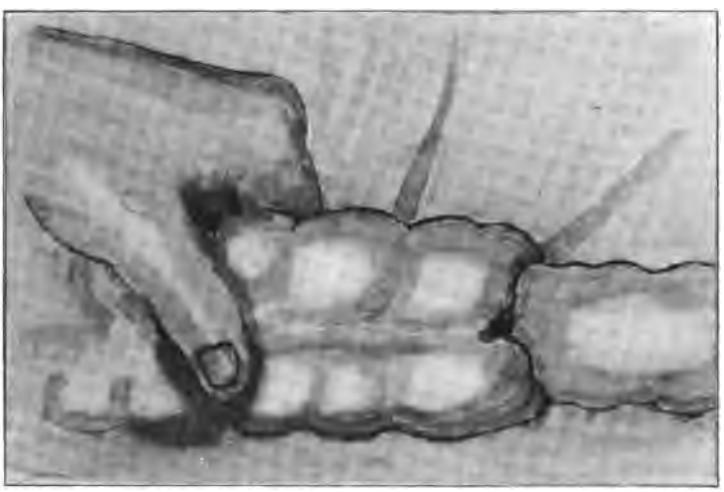


FIG. 64.—Reduction of an intussusception by pressure from below. (Redrawn from Moynihan.)

safety. I remember reading a discussion on this subject a number of years ago, where one surgeon advised far greater pressure. He said that he took a long rubber tube and carried it up to one or two stories above the room occupied by the patient, thus obtaining from fifteen to twenty-five feet head. So much he claimed, that when the water was turned on the pressure was so great that it would run from the patient's mouth. It is doubtful if many surgeons would adopt so daring a procedure.

As the water distends the colon, its weight presses upon the invaginated portion of the gut and gradually forces it back out of the *intussuscipiens,* and when reduction occurs a gurgle is usually heard as when a hernia is reduced. A successful result can not be obtained in all cases by this method, and rather than persist in trying ineffectual measures, it is better to open the abdomen and attempt reduction of the intussusception by direct

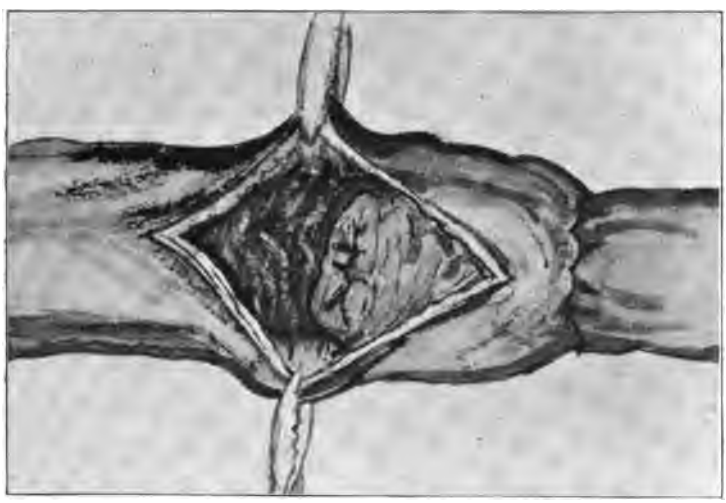


FIG. 65.—Jessett's operation for intussusception. The sheath opened to expose the intussusceptum, which is dragged downward as far as possible before removal. (Redrawn from Moynihan.)

pressure, or if the gut is already gangrenous, make a resection and anastomosis, or, at least, if the patient's condition permits no more, do an enterostomy as a temporary expedient.

If firm adhesions have not formed and the gut is in good condition, reduction should be done, *not by pulling the intussusceptum out of the sheath,* but by grasping the mass and making pressure from below upward, gradually *pushing on the invaginated portion* and unfolding the intussusception. (See Fig. 64.)

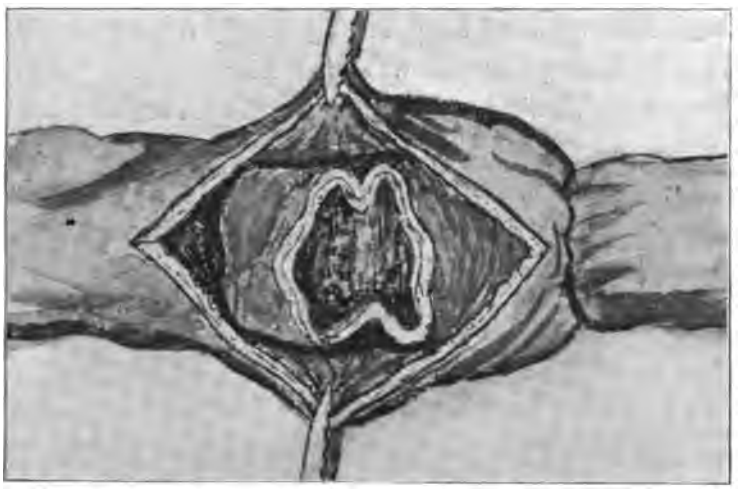


FIG. 66.—Jessett's operation. Removal of the intussusceptum. The division is made closer to the neck than in the diagram. (Redrawn from Moynihan.)

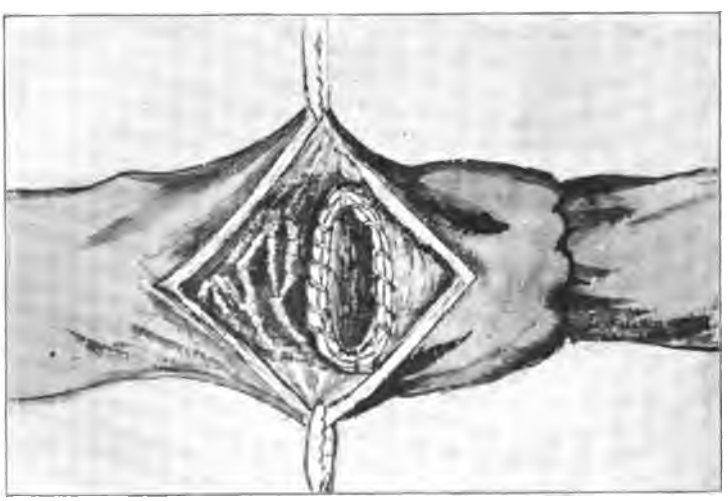


FIG. 67.—Jessett's operation. Suture completed. The stump of the intussusceptum is now withdrawn and the incision in the sheath is closed. (Redrawn from Moynihan.)

If the gut is gangrenous, resection of the damaged portion should be done if the patient's condition will allow of it. An end to end anastomosis with Murphy's button is the quickest method, but there is the usual objection of possible stricture at the point of union, following.

In cases where manual reduction can not be effected and

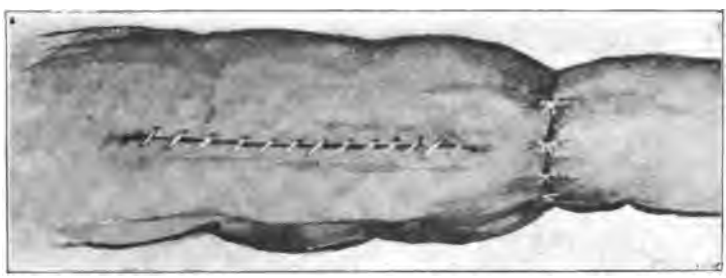


FIG. 68.—Jessett's operation completed. A few interrupted sutures are placed at the neck, and the longitudinal incision is closed by continuous sutures. (Redrawn from Moynihan.)

where the conditions are favorable for its performance, Jessett's or Arthur Barker's operation may be performed. These two surgeons working independently both devised operations almost similar in technique.

The accompanying cuts are sufficiently descriptive for an understanding of the operation.

HERNIA.

The varieties of hernia occurring most frequently in children are the umbilical and inguinal.

The umbilical hernia results from imperfect closure of the umbilical opening after birth, while in case of the inguinal hernia there exists either an open canal or a weakness at the rings which allows of the formation of hernia if subjected to

strain. If under such conditions the openings are not protected and the child is allowed to cry continuously, or if it strains at stool or while urinating from phimosis, hernia is liable to result.

If strangulation should occur, which is not frequent in childhood, it would require the reguar operative treatment.

Most cases of umbilical hernia may be cured in the first year of life by simple strapping over a button mould. This is better than the manufactured trusses because it stays more securely in position.

Take a button mould the size of a twenty-five cent piece (not smaller), cover the convex side with soft white silk, the edges of which are gathered together on the back and fastened with a couple of stitches or a bit of plaster.

Disinfect the skin by washing it off with alcohol, and having reduced the hernia, place the button mould over the opening, convex side down, and strap it tightly in place with radiating strips of Z. O. plaster. These should be left on as long as they stick well and then replaced by fresh ones. Several months of this treatment will usually cure the hernia.

Inguinal hernia may occur at any age, and is frequently found in very young children. Sometimes a scrotal hydrocele is mistaken for hernia, but a careful examination and transillumination will correct the diagnosis. Sometimes scrotal hernia and encysted hydrocele of the cord exist together, and the diagnosis may be puzzling to the inexperienced.

Remembering that hernia in children is usually reducible, and that it goes back with a gurgle and is opaque to transillumination, while the hydrocele, if at all reducible, goes back very slowly, as it flows through a small opening, and that the light shows through it, will aid in the diagnosis.

The treatment of inguinal hernia in a child must depend

largely on circumstances. When it is possible to give the child constant attention and care, as where children are kept for a long time in a hospital or where the parents have means to employ skilled attendance, conservative treatment with carefully fitted trusses may result in a cure if the treatment is instituted and kept up before the child reaches the age of four years.

FIG. 69.—Author's case of large inguinal hernia in a child two years of age cured by Bassini's operation.

If, on the contrary, such facilities are not at hand, or if for any reason there is any objection to the prolonged treatment, a radical operation should be performed.

To my mind age makes but little difference. I have operated

successfully for inguinal hernia in children from one month old upwards, and I see no valid reason for delaying operation on account of the youth of the patient.

Bassini's operation has always proved very satisfactory, and is performed in the following manner:

An incision is made parallel with Poupart's ligament and about half an inch above it, running down over the inguinal canal. The sac is exposed, the fibres of the aponeurosis of the external oblique split, and its edges turned back. The internal oblique and the transversalis are treated in a similar manner, and all the edges held apart by retractors. Then the sac is drawn up and opened at its apex and the cut edges held with a couple of pairs of artery forceps. This makes it easier to distinguish and separate the sac from the spermatic cord than where the sac is left closed.

After the separation is complete the base of the sac is ligated either with sterile silk or ten day chromicized catgut. As this is done, care should be observed that no portion of the intestine or omentum is caught in the ligature. Pushing back these structures with the tip of the finger, which is gradually withdrawn as the ligature is tightened, will prevent this accident. The sac is then cut off. In some cases it is difficult to separate a thin, delicate sac from the cord, and it is better to pass a purse string suture around its base, avoiding the cord, and then close the aperture, even though the sac is not entirely removed from the cord.

After ligating the sac the cord is held up while the edges of the internal oblique and transversalis are united, the cord emerging at the highest point of the slit. Then allowing the cord to rest on the floor formed by the union of the last named muscles the aponeurosis of the external oblique is stitched firmly over it to form a roof for the new canal. As in all ab-

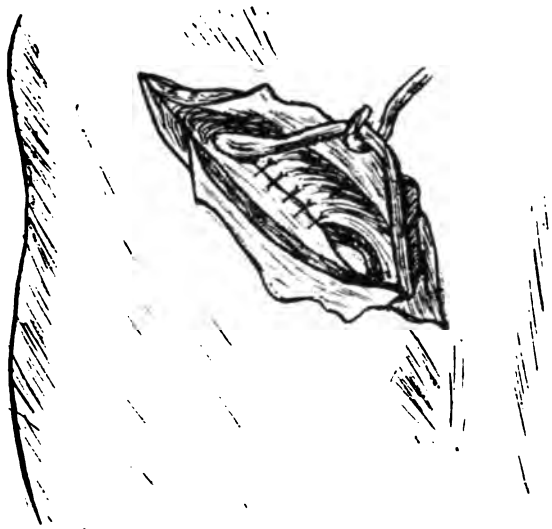
dominal operations, I prefer to unite tendinous structures with a long-lasting suture material, and for this purpose I use kangaroo tendon. Most operators prefer interrupted sutures, as shown in the illustrations, but I prefer a running suture as being equally effective, and it does away with so many knots, which are objectionable in buried sutures.

The external wound may be united according to the preference of the operator. Personally, I employ the mixed method

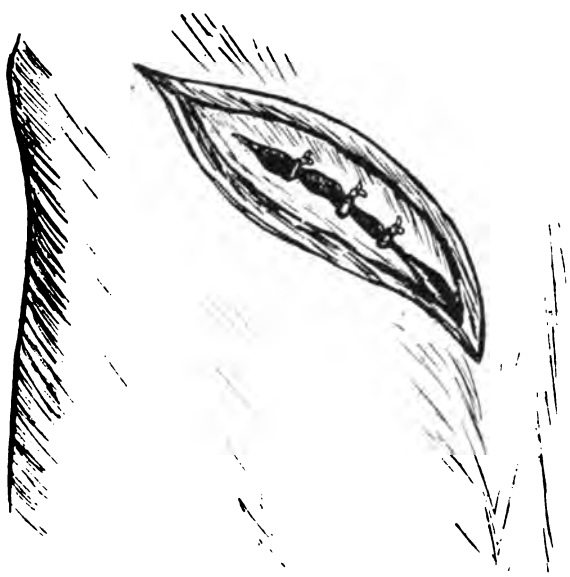
A—Showing ligated sac at bottom of opening through muscles, cord held up on blunt hook.

of silk worm gut sutures with strapping in the intervals as described in the article on appendicitis.

Being a firm believer in the theory that an antiseptic dressing is safer than a simply aseptic one, I always apply a thin layer of gauze wet in bichloride solution next to the wound. Over this is placed a dry sterilized pad, which is strapped firmly in place and held by a spica bandage. Under the outer layers of the bandage may be placed a piece of rubber tissue which



B—Closure of internal oblique and transversalis muscles. Cord emerging from upper extremity of wound.



C—Closure of aponeurosis of the external oblique over the cord which lies in new canal.

FIG. 70.—Bassini's operation for inguinal hernia.

will prevent the dressings becoming soiled by urine in the case of young children.

For more perfect protection of the wound and to insure rest during convalescence many operators prefer to apply a plaster of Paris cast. The child should be kept in bed for three weeks, when, if healing is perfect, he may be allowed to go about, but with the protection of a truss with a large, soft pad.

Many surgeons object to this, considering it unnecessary.

In a late article on "Two Thousand Operations for Hernia," by Coley and Bull, it is stated that in a large proportion of cases transplantation of the cord is unnecessary. Especially is it of advantage not to do so in cases where the testicle has been retained. In such cases the testicle is not removed, but the cord is placed in the normal canal, because if it is transplanted the cord is shortened so that the testicle can not be placed in the scrotum.

MALFORMATIONS OF THE ANUS AND RECTUM.

One of the most important duties of the obstetrician in relation to the newborn child is to ascertain whether or not the rectum and bladder have their normal exits. He should always inquire within a few hours after the child's birth if it has passed meconium and urine. If it has not he should make an investigation and find out why. If the child has not urinated the passage of a smooth round pointed probe or a soft bougie through the urethra may effect the dislodgment of a soft brick red calculus, or by the simple suggestion arising from the presence of the instrument in the urethra induce urination. Terebinth 30 may be given.

If meconium has not passed it is probable that a much more serious condition is present, and one which may require immediate operative relief to save the child's life.

The congenital malformation of the anus and rectum are given by Tuttle (Diseases of the Anus, Rectum and Pelvic Colon), as follows:

ANUS.

"a Entire absence of the anus.

"b Abnormal narrowing of the anus.

"c Partial occlusion of the anus.

"d Absolute occlusion of the anus.

"e Anal opening at some abnormal point in the perineal, scrotal or sacral region."

RECTUM.

"a Rectum entirely absent.

"b. Rectum arrested in its descent at a point more or less removed from the anus, the anus being normal.

"c Rectum opening into some other viscus, the anus present in its normal position or absent.

"d Rectum and anus normal, with the exception that the ureter, bladder, vagina, urethra, or uterus opens into it."

The different varieties of the malformations are well shown in the cuts.

The conditions calling for immediate surgical interference are "a" and "d" in the first series and "a" and "b" in the second. The other conditions do not prevent the passage of the bowel contents, and may be left until later when the child is stronger or well grown and better able to bear an operation.

Where no opening exists into the rectum the child usually suffers great pain and dies within a week. "It is restless and soon begins to strain; the abdomen becomes tense and swollen, and after a few days the child ejects its food, digested or undigested, according to the state of the stomach." (Tuttle.)

FIG. 71.—Malformation in which the peritoneal cul-de-sac extends between the blind ends of the rectum and anus. (Redrawn from Tuttle.)

The diagnosis is easily confirmed by examination. If an anus exists, the little finger, well oiled, should be passed up into it. If the canal ends in a *cul-de-sac* the diagnosis is clear. If, as it may happen, the finger passes well up and does not meet with an obstruction, and still the other symptoms persist, one may suspect the existence of occlusion in the rectum at a point higher up.

An attempt should be made to ascertain if the rectum comes well down to the perineum. By placing one finger in the anal pouch, if one exists, or on the perineum, if it does not, and pressing or pushing downward on the abdomen with the other hand towards the pelvis, an impulse may be felt, or it may be felt when the child cries or strains. Some writers advise listen-

FIG. 72.—Anus opening at the coccyx. (Redrawn from Tuttle.)

ing with the stethoscope over the perineum for the sound of gas moving in the rectum.

Where occlusion of the rectum is found at birth, one of two locations for opening the gut must be selected. If the perineum bulges when the child cries or when supra-pubic pressure is made, it is probable that the rectum ends low in the pelvis.

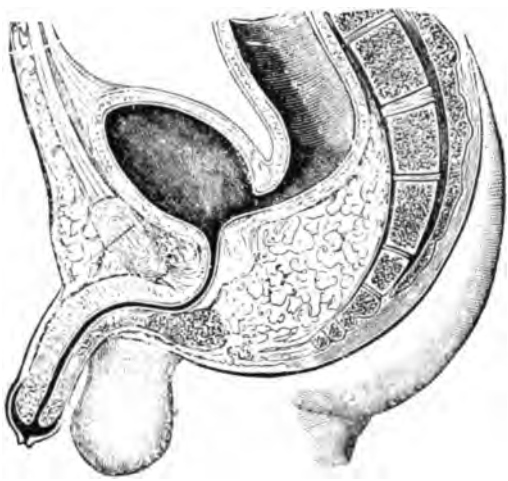


FIG. 73.—Rectum terminating in the bladder. (Molliere.)

FIG. 74.—Imperforate anus, the rectum opening into the vagina. (Adapted from Gant.)

FIG. 75.—Narrowing of the anus without complete occlusion. (Gant.)

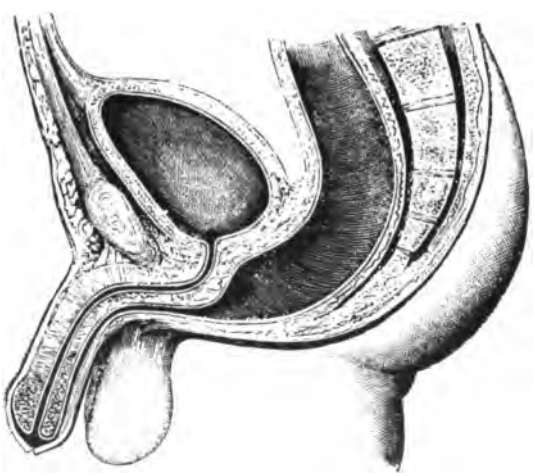


FIG. 76.—Both rectum and bladder opening through the penis.

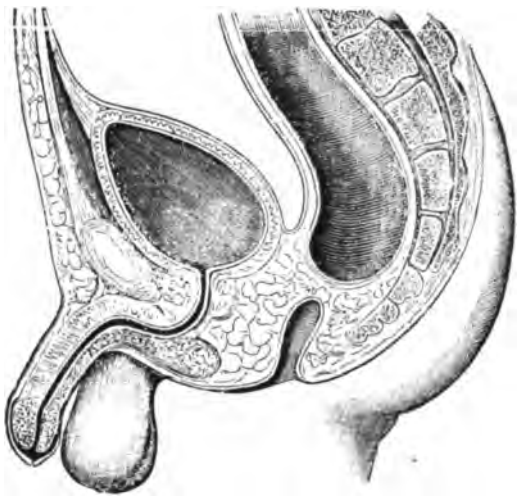


FIG. 77.—Rectum and anus fail to meet. (Molliere.)

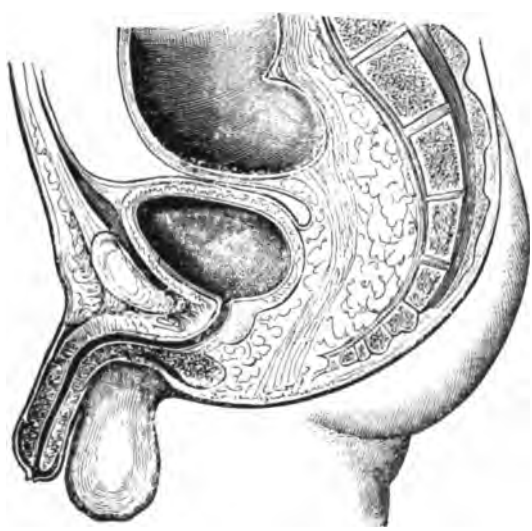


FIG. 78.—Rectum arrested in its descent. Anus absent. (Molliere.)

The absence of this sign is not a certain indication that the rectum has not descended, but it is confirmatory if present.

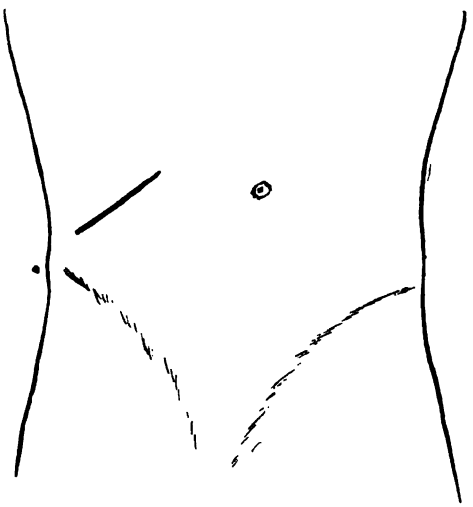


FIG. 79.—Incision for lumbar colostomy. (Hartmann.)

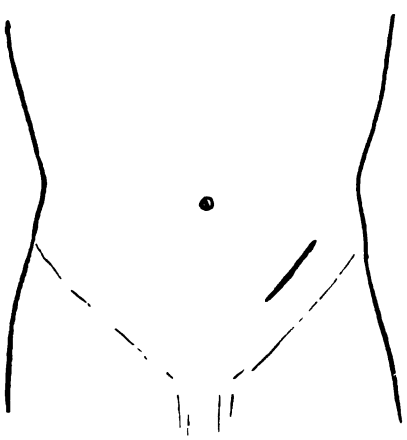


FIG. 80.—Incision for inguinal colostomy. (Hartmann.)

According to Jacubowitsch, in a normal child at birth the distance between the tuberosities of the ischia is two inches, and the distance from the coccyx to the symphysis is 2.4 inches.

A marked reduction in these measurements in a case of rectal occlusion is significant of a high location of the rectal pouch, although normal measurements are not a sure indication to the contrary. (Steinthal, in v. Bergmann-Bull.)

The old operation of plunging a trochar upward into the pelvis from the perineum with the expectation of reaching the rectum is exceedingly dangerous and may result fatally, especially if the condition shown in Fig. 71 should be present, where a pouch of peritoneum intervenes between the rectum

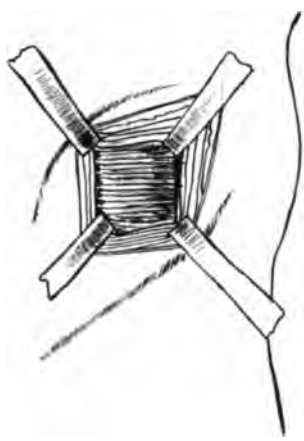


FIG. 81.—Inguinal colostomy. Separating muscular fibers. (Hartmann.)

and anus. If it seems probable that the rectal pouch is low, an incision should be made backward from the anus, if present, or from the scrotum in the male, or the perineum in the female to the coccyx. If the anus is present its lining membrane should be dissected out without injuring the sphincter. Then the soft parts should be divided directly back to the coccyx, being careful always to keep the incision directly in the median line. After separating the perineal muscles an attempt to feel the bulging rectum should be made with the finger. If it can not be found and more room is required the coccyx may either be

removed or fractured and pushed backward, or it may be split and the two halves drawn aside. Then the search is carried further by blunt dissection up into the hollow of the sacrum. If the rectal pouch is low it may be drawn out with clamps and opened carefully so that the wound is not soiled by the escaping meconium. After washing out the rectum carefully the edge of the mucous membrane should be stitched very accurately to the skin in order that no raw surface be left to cause subsequent cicatricial contraction.

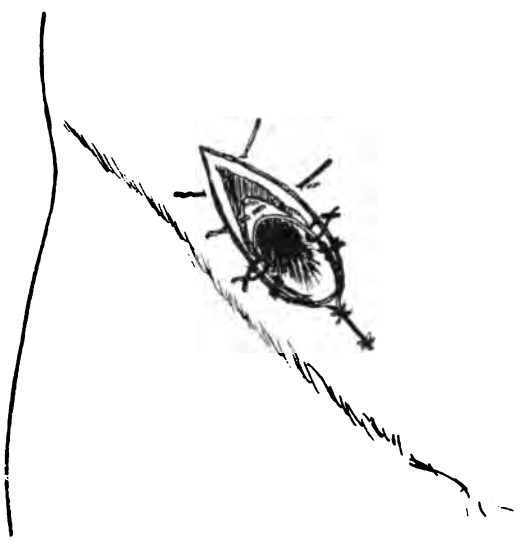


FIG. 82.—Artificial anus. Immediate opening of the bowel. (Hartmann.)

If the rectal pouch is high up a considerable dissection may be required before it can be brought down low enough to effect the union between the mucous membrane and skin.

In some cases it may be even necessary to open Douglas's cul-de-sac in order to secure the rectum, and this gives additional risk, requiring extraordinary care in the operation.

If it is found impracticable to relieve the patient through the perineal route the surgeon must resort to the formation of

an artificial anus. This should be done by making an incision from 1½ to 2½ inches long in front of the anterior superior spine of the ilium and parallel with Poupart's ligament. As soon as the peritoneum is opened the sigmoid should be drawn into the opening. If this portion of the intestine is tightly distended with meconium it may be necessary to empty it by pressing the contents back into the colon.

A—Showing establishment of fæcal fictula.

B—Suture of bowel to peritoneum by sutures not penetrating lumen of bowel.

C—Suture of bowel to skin by sutures which penetrate all the coats.

FIG. 83.—Artifical anus. (Hartmann.)

After the gut is drawn well out, it should be carefully stitched to the edges of the peritoneum and then to the skin. Also a filet of iodoform gauze may be tucked through a slit in the mesentery underneath the fold of intestine. Then after packing gauze closely about the loop, the bowel should be cut —half, in two—crosswise to allow its contents to escape. On

account of its urgency this operation should not be done in two stages, and for that reason extraordinary precautions must be taken to avoid soiling the wound, and the dressings must be changed frequently.

It has been observed that after this operation it is sometimes easy to make the perineal opening and allow the vaginal opening to close. The introduction of a sound into the inguinal

FIG. 84.—Establishment of an artificial anus. Gauze drawn through mesentery. (From v. Bergmann-Bull.)

opening will give the operator an idea of the distance to which the rectal pouch can be pushed downward.

When congenital fistula exist and there is sufficient exit for the bowel contents, the operation, if any is done, may be left to a more favorable time. The operations for the relief of imperforate rectum are attended with high mortality, but, as without operation the result will be fatal, there is no choice but to operate as quickly as possible.

RECTAL POLYPUS

Rectal polypus is much more frequently found in children than hemorrhoids. The polypus consists of a fibrous growth varying in size and loosely connected with the mucous membrane by a long pedicle.

This growth comes down with the stool and drags with it a portion of the mucous membrane, inducing prolapse. Some bleeding may occur with the movement, giving the impression that the patient has bleeding piles, which seldom occur in children. Actual observation and examination lead to a correct diagnosis. The treatment is purely surgical. Under an anæsthetic the speculum is introduced, the polypus is grasped with a pair of volsellum forceps, the pedicle held by a clamp and the distal portion cut away about one-third of an inch from the clamp. This stump should then be slowly charred with the cautery at a low red heat until it is tough and leathery. The clamp is loosened and the stump observed to see if any bleeding points show. If they do they should again be touched with the cautery.

The prolapsed portion of the gut is then returned to the rectum and the patient kept in bed until it is reasonably certain that no bleeding will follow.

PROLAPSE OF THE RECTUM.

Prolapse of the rectum is a generic term embracing all cases where eversion of the rectum takes place. It may be incomplete or complete.

The incomplete is where only the mucous membrane is

turned out. This is also known as *prolapsus ani.* The complete is where all the coats of the rectum come down, and is known as procidentia of the rectum. This form is also known as *prolapsus recti* as distinguished from the former.

Prolapse of the rectum is not uncommon in children, but the protruding portion consists usually of mucous membrane, which comes down with the stool, and may return spontaneously, or require to be pushed back by hand.

A diagnosis between simple prolapsus of the mucous membrane and procidentia of all the coats may be made by the appearance of the protruded gut. If the folds run longitudinally only the mucous membrane has come down. If the folds run around the gut all the coats are included.

The causes which may particularly apply in cases of children as given by J. P. Tuttle (Diseases of the Anus, Rectum and Pelvic Colon) are, in the incomplete:

"1. Whatever separates the mucous from the muscular wall of the gut, such as œdema or inflammatory effusion into the submucosa. * * *

"2. Those conditions which produce weakness or dilatation of the sphincter muscles, such as exhausting diseases, paralysis, incisions, over-distension, sodomy, and traumatic injuries to the sacral plexus of nerves.

"3. Whatever mechanically drags down upon the mucous membrane, *i. e.,* hemorrhoids, tumors attached to the mucous membrane, polypus and hard, costive stools.

"4. All those diseases and conditions which produce increased peristalsis and straining at stool, such as pin worms, foreign bodies in the rectum, ulcerations, proctitis, urethritis, * * * cystitis, stone and phimosis.

"5. Prolonged sitting and efforts at defecation. *The pernicious habit of seating little children on the vessel, and com-*

pelling them to sit there until the bowels move, is one of the most frequent causes. * * *

"6. Diarrhœa, especially the summer diarrhœa of children, dysentery and cholera morbus with excessive vomiting, all may bring about this condition."

Dr. F. Schmey (Tuttle, Dis. of Rectum, etc., Centralblat fur Kinderheilk) claims that nearly all cases of prolapsus in children are due to rachitis.

FIG. 85.—Prolapse of the rectum.

The diagnosis is usually easy, but it is always well to note particularly whether there is any local condition which acts as a cause of the prolapse, as a polypus which, being extruded, drags down the mucous membrane.

The appearance of the protruded gut at first is like that of an ordinary mucous membrane, but if allowed to remain down

it may be caught in the grasp of the sphincter and become darker and more congested, and even go through all the stages of strangulation until it becomes gangrenous.

TREATMENT.—For children, especially in prolapsus recti, Lilienthal recommends: "Ign., Indigo, Nux v., Pod; other remedies, Ham., Merc., Phyt. and Sulphur. To remove the disposition, Ars., Cals. phos., Lyc., Phos., Ruta, Sep., Sil., and Thuja."

Schmey (Centralblat fur Kinderheilk—Tuttle) recommends phosphorus in increasing doses in prolapsus in children, and claims that nearly all cases may be cured by its administration.

As prophylactic to prolapsus all the exciting causes mentioned previously should be avoided as far as possible or corrected. Defecation with the child lying on the side may prevent the prolapse. After each movement a couple of ounces of astringent solution, white oak bark (Da Costa), may be injected and allowed to remain in the rectum.

Reduction of the prolapsed portion may be easy or difficult. In an ordinary case the child should lie down or be placed in the knee and chest position, the parts first washed with cold water, then oiled and gentle taxis made until the gut returns within the sphincter. In more difficult cases the patient may be anæsthetized and wholly or partly inverted and Tuttle's method employed. This is to place a piece of tissue paper over the index finger and push it up into the apex of the cone. The tissue paper sticks sufficiently to the mucous membrane to carry it along with it as far as the finger can reach. Then slipping the finger out of the paper, leave it there; take another piece and repeat the process until the reduction is complete.

While the operative measures may not be required in children, still it is well to have them in mind for severe cases.

Allingham's method consists in drying the mucous membrane and then applying to it acid nitrate of mercury or nitric acid, then oiling and reducing the prolapsed part.

Van Buren's method: After anæsthetizing the patient, the bowel is prolapsed, dried and then the actual or thermo-cautery is applied so that it burns narrow strips running lengthwise the gut. These strips are about half an inch apart. The cauterization should extend down to, but not through the muscular coats. The part is then oiled and reduced and an oil soaked plug wrapped round a good sized rubber tube should be placed in the rectum and left there for four or five days, when an enema may be given through the tube and the plug expelled with the movement.

Dissection of elliptical strips of membrane and sewing the edges of the wound together with catgut may be tried, but, as a rule, the use of the cautery is more effective.

The much more radical operations of rectopexy and sigmoido-pexy for the severer forms are seldom called for in children.

For the after treatment it may be necessary to confine the patient's bowels for a few days after the operation. Of course, the child should be kept quiet in bed for two or three weeks, and all acts of defecation should be performed lying down. The buttocks should be strapped together and straining at stool avoided as much as possible.

PHIMOSIS, ADHERENT HOOD OF THE CLITORIS—THEIR EFFECT ON CHILDREN AND METHODS OF TREATMENT.*

It is a trite saying, but none the less true, that the profoundest mental impressions are those made in early life, because at that period the mind is in its most receptive stage. A child is a thing of impulses and emotions, with undeveloped conscience and reasoning powers. To it, the things which seem pleasing are the things to be indulged in, while the things which are unpleasant are to be avoided or gotten rid of. It is not a question as to whether a certain act is right or wrong, but simply as to its desirability or undesirability. Ultimate effects are not considered by the child. It wants what it wants at once, regardless of future cost.

If, in the effort to get rid of something irritating, a pleasant sensation is evoked, it will not be long, if the irritation persists, before the impulse to produce the agreeable sensation becomes the primary object: while getting rid of the irritation, is secondary or only acts suggestively, and all this may occur without any knowledge on the part of the child that it is doing wrong. Constant and prolonged irritation may be worse in its effects than an occasional severe injury, and may produce more lasting results on the disposition, health and character of the child.

Masturbation as a habit in children may be induced as a result of local irritation, and the practice, which is begun innocently, may be most difficult to overcome. In this article it will

*The greater part of this article was read before the New York State Homœopathic Medical Society, February, 1906, and published in the Hahnemann Monthly, May, 1906.

be understood that I am speaking only of physical causes: confining myself entirely to the condition of the sexual organs known as phimosis in the male and adherent hood of the clitoris in the female.

In both cases the symptoms result from adhesion of the covering mucous membrane to the surface of the gland, and the retention of masses of smegma between them.

I do not propose to dwell on the appalling ignorance of many parents, or the carelessness of some physicians who neglect to examine for the cause of the symptoms, or who allow it to remain unremedied.

Perhaps the best way to bring out the gravity of the condition will be to cite a few cases which have come under my own observation.

One day a woman came into my office carrying a boy about eight months old. He was screaming as though he was in a most violent temper. "Can't you do something for this child?" she asked. "He has been like this ever since he was born." I found that he was suffering from an aggravated form of phimosis. He was circumcised, and the day following the mother told me that he had slept all night for the first time in his life.

A young boy, who was moody, abnormally sensitive and morbidly conscientious, became normal and like other boys after circumcision.

Within the last week I circumcised a youth of seventeen whose preputial orifice would only admit of the passage of a small probe. The prepuce ballooned every time he urinated and gave him a great deal of annoyance. Since the operation he has told me that it is a positive pleasure to urinate.

Many other boys have suffered from preputial inflammation, herpes-preputialis, as well as from many symptoms of nervous irritability—sleeplessness, eneuresis and local itching

and irritation. I have known professionally two men who have died past middle age from cancer of the penis. In neither of these cases had the prepuce ever been retracted.

One of these men was well known to the public, and his intimate relations with more than one woman were matters of common scandal. When I saw him in consultation there was a disgusting sero-purulent discharge oozing from the prepuce and he was obliged to keep the penis wrapped in handkerchiefs. I advised operation, but he refused it at the time, although it was done later, but too late to save him.

I believe that the local irritation had much to do with provoking morbid sexual desire.

In female children various nervous symptoms are attributable to adherent hood of the clitoris.

A little girl four years of age used to awaken every night with violent fits of screaming, which were quite uncontrollable. On examination I found that the hood of the clitoris was tightly adherent to the gland. The night after it was freed by the method which I shall detail later, she woke up, but did not scream, and only asked for a drink of water. Since then she has been quite normal.

Two little girls in one family, one of six years and the other three years of age, were noticed rubbing the genitals, which were very red and irritated. The clitoris and its hood were closely adherent in both cases. Careful watching, correction by the mother and nurse had no effect in stopping the habit, and the elder became a very persistent liar regarding it. Freeing the hood gave a good result, although in one of the children there was a partial relapse after a few months, when it was discovered that there was some readhesions. A short time ago a young girl of seventeen was brought to me by a woman physician. The girl was exceedingly nervous, the uterus was

retroverted, one ovary was inflamed and enlarged, and the hood of the clitoris tightly adherent. She owned up to being a confirmed masturbator and had contemplated suicide. In this case I cut away the hood of the clitoris, performed ventral fixation of the uterus and removed the diseased ovary. The result has been a complete cure.

There is no use in multiplying evidence. The symptoms vary in character and intensity in different cases, and all the physician needs to do to ascertain the cause is to make an examination. The next thing is to relieve the patient by proper operative methods. Fussing with medicines, constant washing of the organs and retraction of the prepuce only serve to attract the child's attention to it, while simply stretching the foreskin in the male or breaking up the adhesions in the female are soon followed by relapse.

In boys circumcision only will be of any use, and in my opinion it is better to employ the "ounce of prevention" by doing the operation in babyhood. In fact, if possible, I circumcise all male children, where I attend the mother in confinement, on the eighth day.

If the operation is done during the first few days of the child's life, no anæsthetic is required. If allowed to suck on a lump of sugar wrapped in a piece of gauze, the child will hardly notice the operation. At this period of life sensibility is low, and there seems to be little or no pain. When older, a few whiffs of chloroform are generally sufficient. Cocaine as a local anæsthetic should not be employed. If the patient is not more than a month old, sutures are hardly necessary, although one or two fine catgut sutures may appear useful. In older children either catgut or silk are generally required.

Perfect asepsis is necessary. I have seen very unpleasant consequences resulting from a neglect of this injunction. The operation is performed as follows:

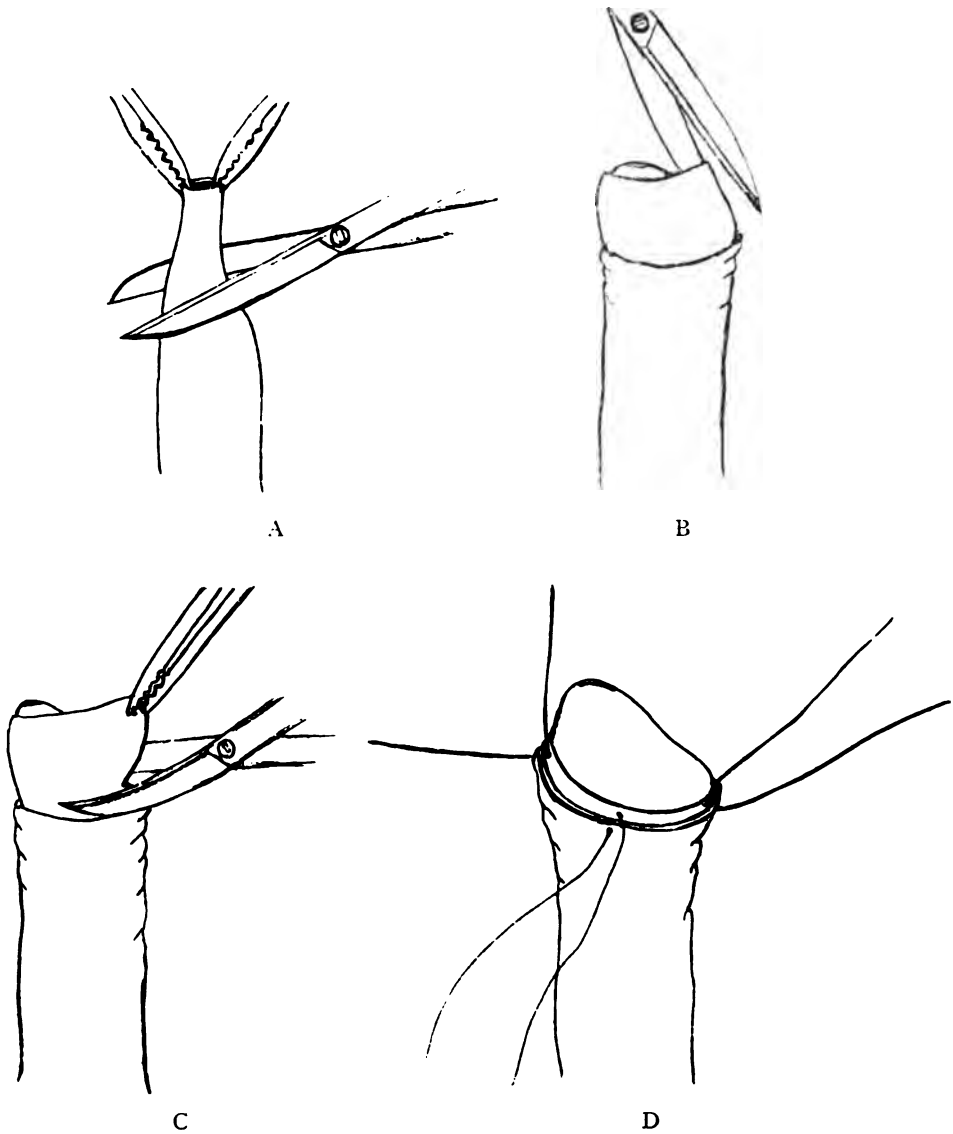


FIG. 86.—Operation of circumcision.
A—Clipping off the redundant prepuce.
B—Splitting the mucous membrane along the dorsum.
C—Trimming the mucous membrane.
D—Sutures applied. The first one the frenum and raphe.

First, the adhesions are broken up by passing a stiff probe around between the prepuce and the glans. Then the prepuce is caught above and below in the tip-ends of two pairs of artery forceps at the junction of the skin and mucous membrane, and drawn forward. A pair of straight bladed forceps may be clamped across the foreskin just in front of the glans for a guide, but it is not necessary, as the skin can be easily clipped off at one stroke with straight bladed scissors.

There are two points to be borne in mind in doing this operation: First, not to cut the skin too short, and second, not to leave the mucous membrane too long. If the skin is cut too short it will give trouble afterwards from insufficiency during erection, while if the mucous membrane is left too long, contraction and paraphimosis may ensue, or there may be readhesion between the prepuce and the glans. In fat babies especial care should be taken not to cut the skin too short. It is better to leave it long enough to roll well forward over the corona after the stitches are tied. The frenum should not be cut so short that its artery is injured. A hint on this point may be gained from the statement made to me by a physician who, after the death of his first wife, had himself circumcised in order to avoid any source of sexual irritation. He said that the surgeon who performed the operation cut the skin very short, and to this he ascribed the fact that on marrying a second time he found that sensation during coitus was entirely absent.

After clipping off the foreskin retract the skin and slit the mucous membrane up the dorsum clear through over the corona and trim it around, leaving only a narrow collar not over one-eighth of an inch in width. All bleeding should be stopped before suturing or a troublesome hæmatoma may result.

The first stitch should bring the raphe and the frenum in apposition. The second should be placed at the dorsum, and then one or two more on each side as may be required for perfect approximation.

A dressing should be applied. Simply dusting the wound with aristol or other dry powder is not sufficient.

As a dressing I find a narrow strip of iodoform gauze wound three or four times around the penis to act well. The ends should be fastened to the skin over the pubes with flexible collodion, and the folds of gauze around the penis fastened together with one or two little patches of collodion. The collodion should not be put on all around the organ, for fear of causing constriction. This dressing may be left in place for four or five days, and then the child allowed to sit in a bath until it soaks off, when the wound will generally be found to be healed.

Dehooding the Clitoris.

This operation is not done as frequently as circumcision, but if physicians were more observing and more careful in making examinations of nervous or so-called "cantankerous" little girls, it would be much more frequently performed, and much needless suffering avoided.

The ordinary method of separating the hood from the clitoris and then trying to prevent readhesion by tucking in bits of gauze, applying ointments, etc., have proved quite unsatisfactory. Therefore, I was led to devise the operation described below, which has been employed with excellent results in a good many cases. General anæsthesia should be used in every operation of dehooding. The operation is very painful, and it is cruel to subject a delicate little girl to the pain and nervous shock. Cocaine is of no use.

The adhesions are broken up with a blunt instrument—never a sharp one. Frequently hard masses of smegma will be found imbedded in the mucous membrane, and they are often removed with difficulty.

To keep the mucus surface separated, a piece of sterilized rubber tissue, which is not old enough to be brittle, is backed by a little roll of iodoform gauze. A string of horse hair, with a needle on each end, is passed through the gauze and tissue as shown in the diagram. (Fig. 87.) The gauze is used simply

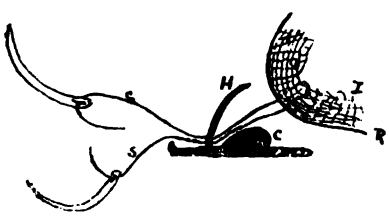


FIG. 87.
C—Clitoris.
H—Hood.
R—Rubber tissue.
I—Iodoform gauze.
S—Horse hair stitch.

FIG. 88.
K—Knot in horse hair. Stitch tied over filet of gauze above hood.

to prevent the suture cutting through the rubber tissue. The hood of the clitoris is held up with a pair of forceps while the needles are passed through the hood at the base of the gland, about one-third of an inch apart. The ends are then tied over a fold of gauze in a single bow knot. (Fig. 88.) As the threads are pulled up the rubber tissue is drawn down between the clitoris and its hood, thus effectually separating them for as long a time as the operator thinks necessary. The smooth rubber is unirritating, and it does not stick to the tissues like gauze, and allows the mucous membrane to return to a normal condition in which readhesion is not likely to occur.

I generally keep the rubber in place for a week, but I think

ten days would be better where there is no irritation from the stitch.

Of course the child must be kept quiet and the parts carefully cleansed. After the removal of the rubber tissue, frequent inspection should be made, to see if there is any tendency to relapse.

Remarkable results have followed this simple operation in some of my cases, and I have reason to feel well satisfied with it. On the other hand, it has occurred to me that complete removal of the hood in many cases might be less bothersome and quite as satisfactory.

EPISPADIAS AND HYPOSPADIAS.*

Epispadias and hypospadias are congenital deformities occurring in male children and consist in deficiency of some portion of the urethral walls. They may occur as the result of disease or injury, but infrequently.

The deficiency may exist in any degree, from a slight cleft at the end of the penis, a fistula, or the entire wall above or below may be lacking, so that there is no canal at all. In many cases where the opening is directly into the bladder, either above or below the penis, there is a depression or groove running the whole length of the organ which represents the urethra.

In epispadias there is a deficiency of the upper wall or roof of the urethra, while in hypospadias it is the lower wall or floor of the urethra that is missing.

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*The larger part of this article was originally published in the Medical Century, April, 1904.

In some cases of hypospadias in place of the urethra there is a longitudinal band or cord of inelastic fibrous structure, which acts like a bowstring during erection of the organ, bending it as in chordee. This structure has to be dissected away anteriorly and allowed to slip back when the operation for repair is performed.

When the canal is lacking in epispadias, the opening into the bladder is directly under the pubes. In hypospadias it may be in the anterior surface of the scrotum, or the scrotum may be completely divided, with the orifice presenting between the two halves. Many of the cases of apparent hermaphroditism are really nothing more or less than exaggerated cases of hypospadias. A few years ago a young patient 17 years of age was brought to my clinic at the New York Medical College and Hospital for Women, who was supposed to be a true hermaphrodite. The patient had always dressed as a girl and associated with girls, and the hair was worn long, as would be the case with a girl of that age.

Examination developed the fact that the patient was a young man. The penis was small, and with no sign of a urethra; the opening into the bladder was back of the base of the penis, between the two halves of the divided scrotum. Each half of the scrotum contained a testicle and was mistaken for a labium majorum. Under anæsthesia I was able to pass my little finger directly into the bladder through the supposed vagina. There were no female organs. With the exception of the long hair, the general appearance was that of a boy rather than of a girl; the angular shape and general contour of the limbs, the flatness of the chest, with no appearance whatever of mammary development, all indicated the male sex. He was entirely ignorant of his sex or condition, and was subject to fits of depression on account of the strange physical

sensations from which he suffered at times, which he could not understand. I consider this a most unhappy case, and one which might have been relieved by operation, but I was not allowed to disclose his sex to him and he disappeared from my observation.*

All cases of either epispadias or hypospadias become very sensitive about their condition, and even when only children the boys realize that they are not like their playmates.

It is hardly necessary to state that the only remedy for these deformities is in operation, and that the operations are among the most difficult which the surgeon is called upon to perform. For difficulty they may be classed with the operations for the repair of cleft palate or intestinal fistula, and as they are not frequently performed it is of importance that every operator should give the results of his experience.

The operations detailed in this article were original with myself, although I find on later reading that they resemble in many respects those of Anger, Duplay, Nelaton and Thiersch. See Bryant's Operative Surgery, Vol. II., p. 1,236, *et seq.* I have operated on one case of complete epispadias, and four cases of hypospadias, varying in degree, and have had referred to me several cases which have declined operation.

There have been two great hindrances to the achievement of a successful result, one being the difficulty of preventing the stitches being torn out by erections, and the other the drainage of the bladder without irritating the wound and causing suppuration from the presence of a catheter in the newly formed urethra. The first hindrance is one exceedingly difficult to obviate, and in my own experience I have found no remedy which would keep the organ flaccid in strong, young

*Since the publication of this article I have learned that his sex has been revealed to him, and he now dresses in man's clothing.

men. The tendency to erection is, of course, greatly increased by the local irritation of the wound and the retaining sutures.

In one case of a young man on whom I had operated for a moderate degree of hypospadias, the only way in which I was able to overcome the constant erection when asleep, was to apply an open ring of brass ribbon around the organ. This ring was very loose when the organ was flaccid. A tongue of brass ribbon was attached to the inner side, which was insulated from the ring at the joint, and would only touch it with the tip when the influx of blood increased the size of the penis and pressed upon it.

FIG. 89.

The ring and the tongue were each connected by wires to an ordinary house battery and bell, which rang furiously whenever the contact was made. See Fig. 89. This gave warning to the nurse, who sat beside the bed, and he was able to pack ice around the penis in time to prevent disaster. The final result was successful, but the experience of the nights were decidedly amusing. Mono-bromate of camphor or other drugs administered in this case were without effect.

The second hindrance to a successful result can easily be removed by draining the bladder through a perineal opening. This may be done in the manner which is employed in the treatment of deep urethral strictures by external perineal urethrotomy. A good sized catheter is fastened in the perineal opening by one or two stitches, and allowed to remain there for a week, or until the stitches cut out. I believe this method of draining the bladder to be one of the most essential steps to a successful result.

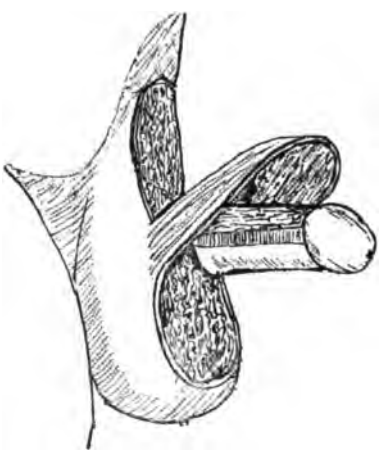


FIG. 90. (From Bryant's Operative Surgery.)

The method which I have employed in the case of epispadias was similar to that of Nelaton, with the exception that Nelaton took a flap from the scrotum to cover the penis. (See Fig. 90.) The patient, a young man of twenty, came to me from Florida. I found on examination that there was a complete deficiency of urethra, there being a slight depression or trough along the top of the penis, and an opening directly into the bladder, but no canal whatever. The pubes was covered with hair, and the opening was so wide that when he ran or walked the urine joggled out of the bladder as it would from a jug

with the cork out. In order to protect his clothing he was obliged to wear a cloth or pad over the opening in the bladder. I sent the patient to Dr. Wm. H. King, who, with great care and patience, removed the hair from a strip over the pubes by means of the electric needle. This required some time for its accomplishment. Then sending him to the Flower Hospital, I operated before the class of the college. First, two parallel linear incisions about half an inch apart were made from the pubes to the end of the penis along the top of the organ. Then a flap was dissected from the pubes and turned, skin side downward, to form the roof of the urethra. Afterwards two

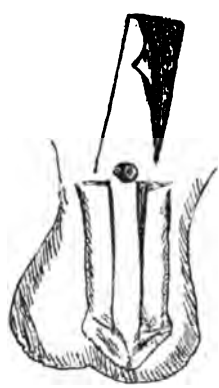


FIG. 91.—Incision in Nelaton's operation. (From Bryant.)

skin (Fig. 91) flaps which had been previously dissected from the dorsum and sides were drawn toward the median line, covering over the flap which had formed from the skin taken from the pubes.

In order to relieve the tension on these flaps longitudinal incisions through the skin were made along the sides of the penis so that the flaps could slide more easily toward the median line. Thiersche's grafts may be used to cover the raw spaces thus made if desired.

A catheter was left in the newly made urethra in the case, but I should advise perineal drainage instead.

The operation was a success, the wound healed well, and the patient was able to pass a stream and to retain his urine at will. The penis, as in most of these cases, was short, how much it lengthened during an erection I was never able to ascertain. He married three or four years afterwards, and rather to the surprise of all those who were acquainted with the case the marriage has been a happy one, although no children have resulted from the union.

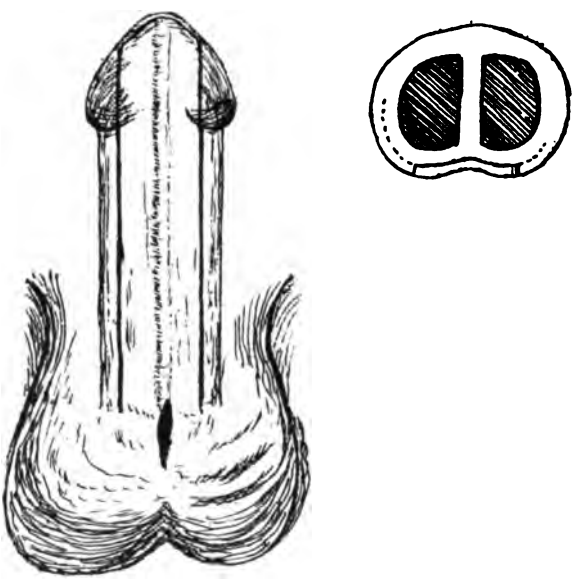


FIG. 92.

Various operations have been proposed for the relief of hypospadias, but the one which I present is original with myself, although as previously stated it includes many points given by other operators.

The splitting of the penis on its lower side and sinking of the urethra into its substance have not to my knowledge been proposed or published by other writers, nor has perineal drainage of the bladder, so far as I know, been done by other operators for this condition.

A study of the cuts giving in full and in cross-section the various steps of the operation will help in understanding the technique of the operation followed in the case of complete hypospadias in a small boy eight years of age. The opening

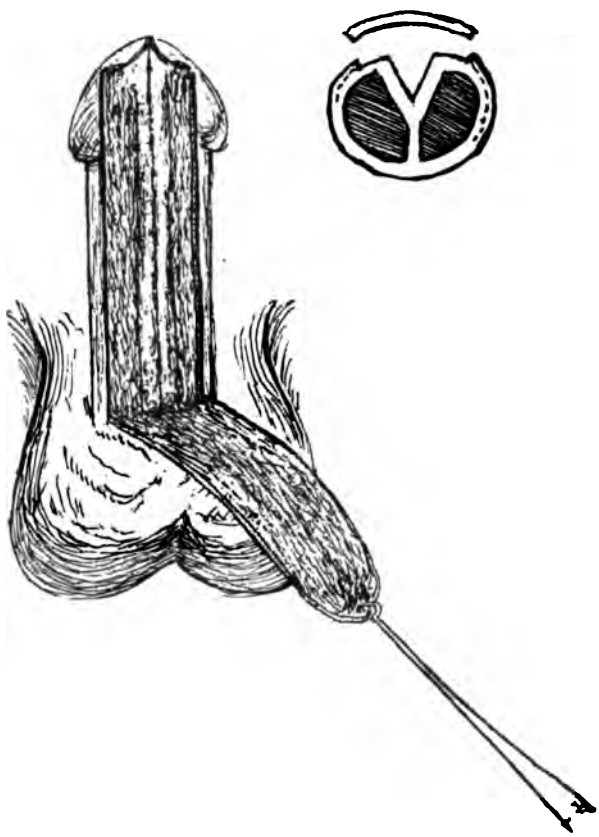


FIG. 93.

into the bladder was at the scrotum, and there was no indication of any urethra whatever anterior to this point. He was obliged to sit on a vessel or water-closet when urinating.

Fig. 92 shows the incision for the skin flap from which the lining of urethra is to be made.

Fig. 93 shows a flap of skin dissected up from the lower side of the penis, and a deep groove cut into lower side of the organ going between the corpora cavernosa to one-half the thickness of the organ. The fear of hæmorrhage has been greatly exaggerated, for, like the tongue, the penis can be split in the median line with little trouble. The base of the flap should be at the orifice of the opening into the bladder.

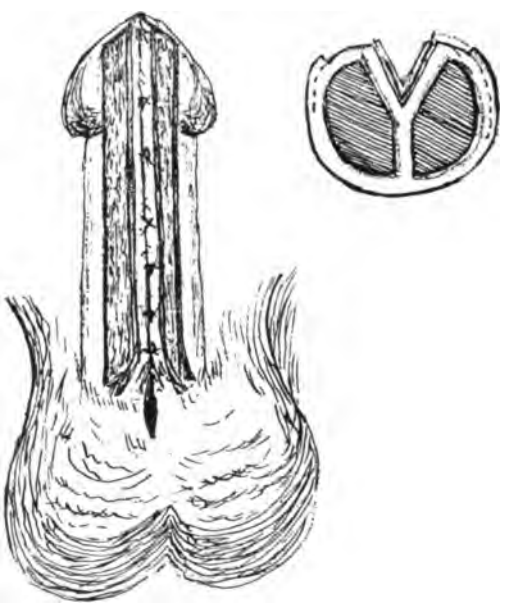


FIG. 94.

Fig. 94 shows the skin flap sunk to the bottom of the groove and stitched in place with fine catgut sutures.

Fig. 95 shows the edges of the groove stitched together in such a way that a new urethra lined throughout with skin is formed. It also shows two lateral flaps of skin, one wider than the other, on each side. These flaps extend back beyond the original orifice which has been closed in.

Fig. 96 shows the operation completed. The skin flaps are stitched with fine silk and perhaps reinforced by a few deep

sutures of horse hair. The reason for the unequal size of the two lateral flaps will be seen here, which is that the two seams may not be one over the other, which adds to the probability of better healing.

Fortunately, in most cases of hypospadias there is a great redundancy of foreskin, which may be utilized in the plastic work, and should never be removed until the result is successful.

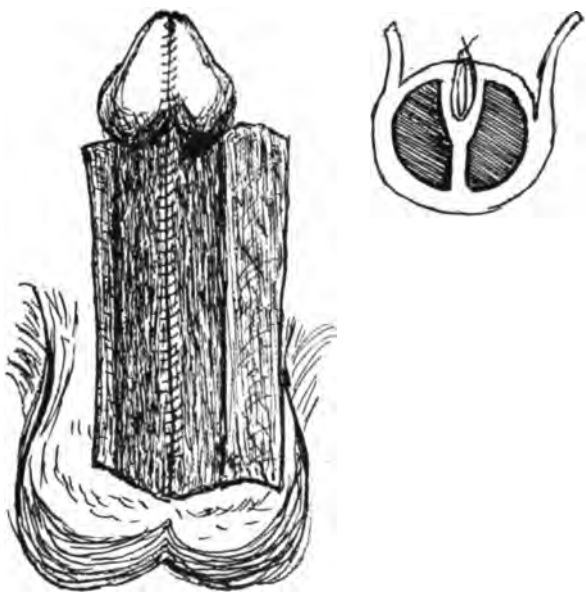


FIG. 95.

For perineal drainage which should be employed in operations both for epispadias and hypospadias, an opening should be made as in the median operation for stone, but it should be made only large enough to admit of the passing of a good-sized catheter into the bladder. The catheter should be fastened into the wound with two or three silk or silk worm gut sutures, which do not pierce the lumen of the tube. As before stated, this tube may be left in place for a week or more, or until the sutures cut out. (See Fig. 101.)

The catheter should also be connected by means of a tube to a sterilized bottle placed under the bed. The mouth of the bottle should be packed with sterilized cotton around the tube so that the air which comes in contact with the urine is filtered and does not cause it to decompose. The tubes and bottles should be changed and sterilized by boiling at least once in six hours. A few drops of formaldehyde in the bottle will also

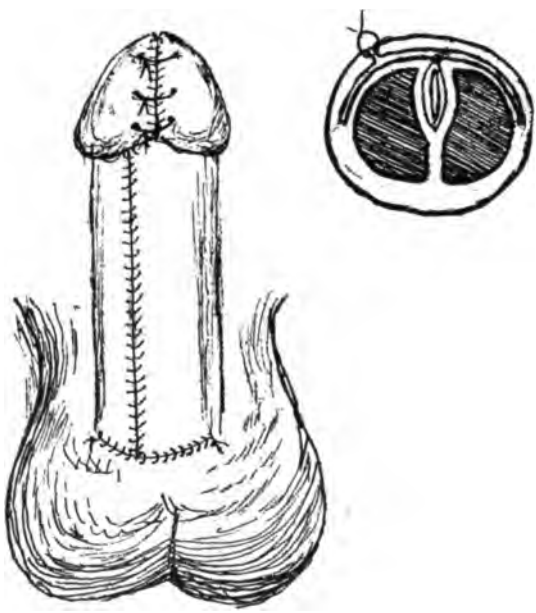


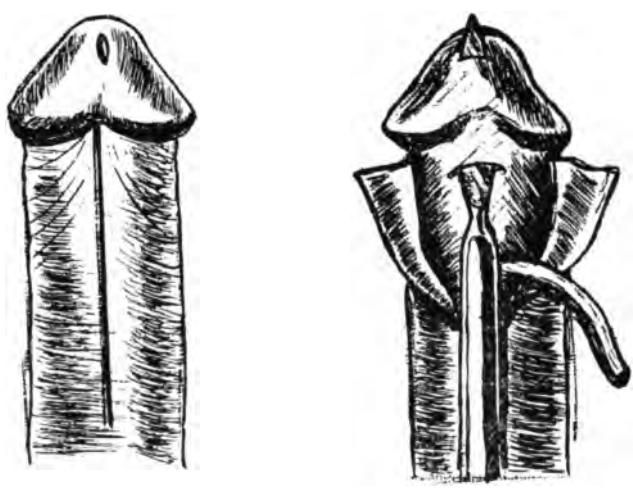
FIG. 96.

tend to prevent decomposition of the urine. The bladder may be washed out from time to time if thought necessary, with some aseptic or normal saline solution, and this is a good practice, as it tends to prevent the deposit of urinary salts upon the catheter. By this means the complete avoidance of urinary irritation is effected, and it is much more comfortable to the patient, adds much to the certainty of success and gives better opportunity for perfect closure of the wound.

The perineal wound closes spontaneously and usually in a very short time after the removal of the tube.

In the case of hypospadias referred to, the whole operation was not attempted in one stage, although I am of the opinion that it might be done successfully. In some cases most of the wound will heal by first intention, but there may be minute fistulæ which will require subsequent operations for complete success.

Beck's operation for balanitic hypospadias is an excellent one.



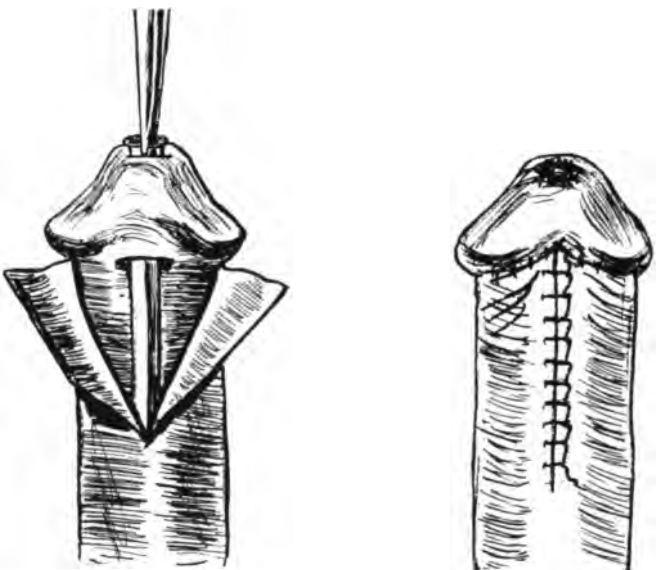
A
A—Lines of incision.

B
B—Making a tunnel for the urethra which is dissected back.

FIG. 97.—Beck's operation.

First, two lateral flaps beginning at the opening of the urethra are turned aside exposing the urethra, which is then dissected far enough back to free it from the body of the penis. Then with a narrow bladed knife the glans is tunnelled through to the tip. Through this passage a pair of forceps is

passed and the end of the urethra grasped and drawn forward as shown in the cuts, and stitched to the edges of the slit. The skin flaps are then replaced.



A

A—Urethra drawn forward into tunnel.

B

B—Operation completed.

FIG. 98.—Beck's operation.

In Rochet's operation for penile hypospadias a director is first pushed forward from the urethral opening under the skin to the base of the glans, then through the glans itself. A flap of skin is next dissected from the scrotum sufficiently wide to wrap and stitch around a No. 21 French catheter. The catheter is then turned itself and drawn through the tunnel, carrying with it the skin flap which is stitched in place. The catheter is pushed back into the bladder for a drain and the denuded portion covered from the sides.

STONE IN THE BLADDER.

Stone in the bladder is not uncommon in children and sometimes soft calculi may be passed within twenty-four hours after birth and found as a reddish soft mass on the diaper.

I have seen a number of cases of stone in the bladder in male children, but never in females, as it is probable that the shorter and wider urethra of the female allows the calculi to pass away spontaneously.

In some boys the presence of stone gives rise to excruciating pain, while in others the pain may be slight for a long time and the presence of stone unsuspected.

This was forcibly impressed on my mind by two cases

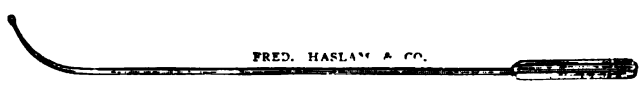


FIG. 99.—Little's searcher.

coming under my care a number of years ago at the Laura Franklin Free Hospital for Children. The first was a boy of ten years who came to the hospital for persistent enuresis. He did not complain particularly of pain. As he had a long prepuce he was circumcised, and curiously enough he was better of the enuresis for a few days.

Then he complained of symptoms which made me suspicious of stone, and on examination with the sound it was found.

I made a suprapubic cystotomy and removed a stone nearly two inches in length and three-fourths of an inch in diameter and slightly dumb-bell shaped. The most surprising part of all was that it was completely covered with sharp crystalline spikes in every direction. The freedom from severe pain was

accounted for by the fact that the stone was so encysted that the walls of the bladder were not brought into contact with the points, as the viscus collapsed after being emptied.

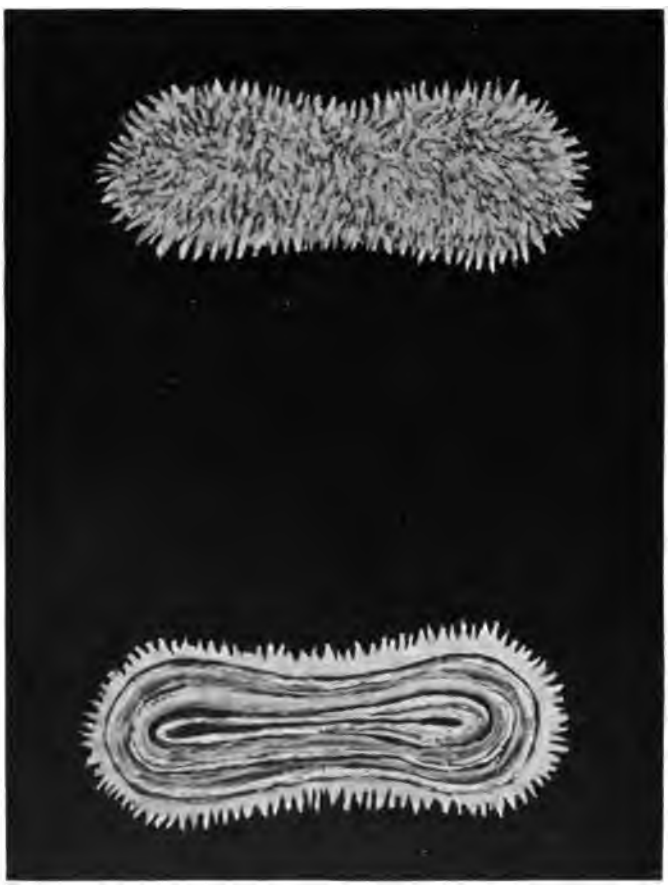


FIG. 100.—Calculus removed by the author from the bladder of a boy ten years of age. This cut is about ¼ larger than the actual size of the stone.

The other case, a boy about the same age, suffered the most intense agony. He was operated on within two weeks of the first case. The stone was no larger than a cherry, but it lay

loose and was caught in the neck of the bladder and pinched at every voiding.

When a child suffers from severe pain and tenesmus on urinating, or pain in the region of the bladder aggravated by exercise or riding, and persistent enuresis, the possible presence of a stone in the bladder should be kept in mind. Pain and tenesmus on micturition in children may arise from the presence of a myxomatous growth in the bladder, and the diagnosis may have to be settled by the use of the sound.

If the presence of stone is suspected the examination should be made by the sound, or, better still, a small searcher. The examination should never be made in a child without a general anæsthetic, for the reason that such a procedure is too painful and terrifying for a child to endure, and also because the nervous spasm induced by the presence of the sound in the urethra may prevent easy manipulation of the instrument.

With the searcher in the bladder and the viscus distended with fluid, the beak of the instrument should be turned first to one side and then to the other, and moved back and forward gently over the floor of the bladder. If a stone is present it will be manifested by a click, which may often be heard throughout a large room.

The presence of stone having been determined, the only thing to do is to remove it by operation. Attempts to dissolve it are absolutely useless.

Suprapubic lithotomy is the only method worth considering in a child, and may be carried out as follows: Under full anæsthesia a sound or metallic catheter is introduced into the bladder. A broad bit of tape is tied around the penis at its base to compress the urethra sufficiently so that the aseptic fluid with which the bladder has been distended will not run out at the side of the catheter. Then depressing the handle of the sound bring its beak forward just above the pubes.

An incision is made in the median line, going down between the recti and pyramidial muscles until the prevesical space is reached. This prevesical space is a portion of the anterior bladder wall which is free from the peritoneum, which is reflected upward and which rolls still further out of the way if the bladder is distended. Wounding the peritoneum is the thing especially to be avoided in this operation, and care should be taken to push the fat in the prevesical space upward and out of the way, and with it the peritoneal reflection. If by accident the peritoneum should be wounded, it should be stitched up immediately. Any bleeding vessels should be caught and ligatured at once.

The bladder is recognized by its reddish brown color, and if the handle of the sound is depressed its beak is felt by the finger in the wound pressing against the bladder wall.

The bladder is caught up with a sharp hook and an incision downward and forward sufficiently large to allow of the introduction of the forefinger into the bladder is made. The bladder collapses as the fluid escapes. The sound should be withdrawn and an examination of the cavity made. If there is one large stone the bladder opening may have to be enlarged. This may be done to some degree by dilatation, or, if more room is required, incision downward and forward or laterally may be made. Then the stone may be caught in the forceps and lifted out.

If there are one or more small stones they may be removed with the scoop, but the operator should be positive that every portion of the calculus is removed. A current of solution forced into the bladder through a catheter in the urethra with the patient turned on his side or face, will carry away small particles that might be otherwise difficult to remove.

The question as to the further procedure is still somewhat

under discussion, but my own belief is that the following is the proper one:

Drainage should be established through a median perineal opening into which a soft rubber catheter is fastened by means

FIG. 101.—Arrangement for perineal drainage after operation on the bladder or urethra.

of a couple of stitches, which do not penetrate its lumen. This catheter should be left in place as long as it will stay.

The wound in the bladder may be closed up with a couple of tiers of sutures, but I think it safer not to close the external

wound but to put in three or four cigarette drains which may be changed as often as necessary. In spite of all that is written to the contrary I am convinced that there is danger of urinary infiltration in some cases, and pains should be taken to guard against it. After granulation has become well established the edges of the wound may be drawn together.

Some authors advise holding up the anterior wall of the bladder by stitching it to the abdominal muscles. I have seen severe spasms of the bladder follow this procedure, and I am not prepared to advocate it.

Perineal drainage is far superior to drainage through a catheter in the penis. It is more certain, it is less painful, and the catheter is much more easily kept in position.

The catheter leading into the bladder through the perineal opening should connect with a tube which leads down into a bottle under the bed, and should be treated in the same manner as described in the chapter on epispadias and hypospadias. If thought best the bladder may be irrigated from time to time with some solution: either a normal saline or boracic acid solution is preferable, not introducing more than a couple of ounces at a time.

When it is pretty certain after a few days that the anterior bladder wound has closed, the perineal drainage tube may be removed and the patient be allowed to pass his urine. As a rule, the perineal wound closes quickly.

STONE IN THE URETER.

In some cases small calculi formed in the kidneys, pass into the ureter and become lodged at one of its three points of constriction.

The ureter is about the size of a goose quill and is capable of great distension under pressure. It is decidedly constricted at a point a little below the kidney, where it crosses over the pelvic brim, and just before it enters the bladder. At any of these points a calculus which would ordinarily pass through the wider portions of the ureter may become lodged. If it is large enough to block the canal the ureter would become enormously distended, causing an easily palpable tumor to appear in the loin or abdomen. If the tube is not completely blocked the urine may trickle by the side of the stone and hydronephrosis not occur.

The symptoms of stone in the ureter are the usual ones of passage of gravel. The pain is excruciating at times. The attacks being followed by hæmaturia. The pain shoots from the region of the kidney down into the groin, and the testicle on that side may be drawn up.

In the case from which the radiograph was taken the patient had suffered for eight years from recurring attacks of pain, the attacks varying in severity from dull aching in the left iliac region to agonizing attacks followed by profuse hæmaturia. If the presence of the stone causes ulceration, pus will be found in the urine.

The stone may remain for a long time in the ureter, and finally in an attack of pain be passed spontaneously into the bladder. Taken in connection with the other symptoms a radiograph is of the greatest value in corroborating the diagnosis; but without the other symptoms I should be loath to operate for stone no matter how plainly the obstruction appeared to show by the X-ray. Other substances throw shadows on the plate which may be mistaken for stone.

If, hydronephrosis occurs, or there are attacks of gravel and the X-ray shows the presence of calculus in the ureter, an ureterotomy should be done to remove the stone.

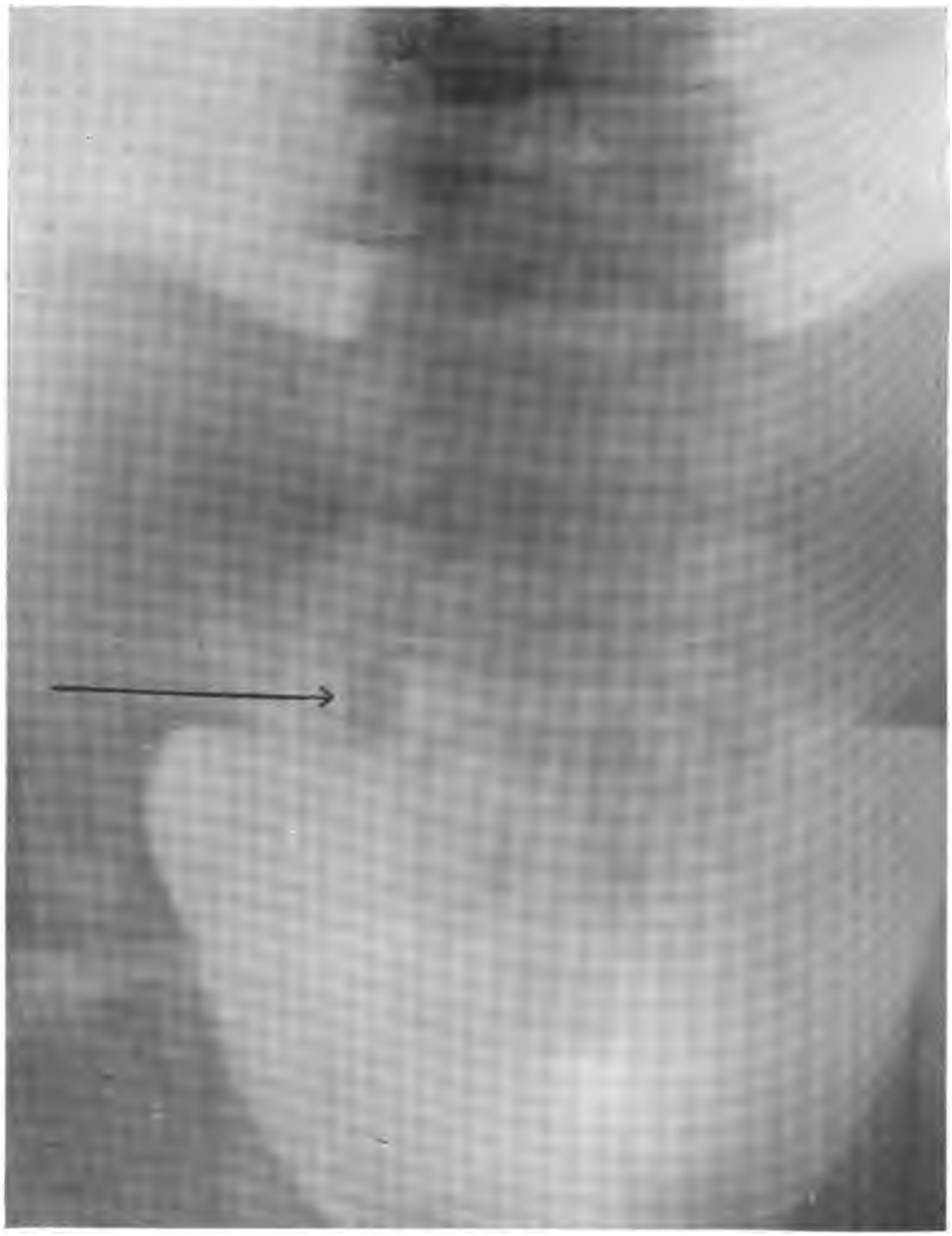


FIG. 102.—Radiograph of stone in the left ureter. (Author's case.)

To accomplish this an incision is made running obliquely downward from the anterior edge of the quadratus lumborum muscle and extending parallel with Poupart's ligament and about an inch above it, as far as is necessary to gain access to the ureter. The peritoneum is not incised, but is held out of the way by broad retractors. The ureters will be found lying behind the peritoneal sac and may be separated and palpated for nearly its whole length. In case the stone is not to be felt, a small longitudinal opening should be made in the ureter sufficient to admit of the passage of an ureteral bougie. This may be pushed gently through the canal and a small stone may be dislodged into the bladder. It is better, however, if possible to make a longitudinal slit directly over the calculus and remove it. Longitudinal slits in the ureter heal quickly, while transverse ones are more uncertain. In closing the opening in the ureter two rows of continued sutures may be employed, the deeper layer being of fine catgut. The superficial one may be of catgut or fine silk. If the field of operation is clean the wound should be closed without drainage. If there is any fear of infection a tube or cigarette drain should be left in place for two or three days.

The muscles should be carefully approximated, the soft portions with catgut, and the strong fascia with kangaroo tendon. The cicatrix should be well supported for months with adhesive strips applied as shown in a former chapter.

HYDROCELE.

Hydrocele occurs frequently in male children even during early infancy. It may occur idiopathically or result from some disease, and may accompany tubercular peritonitis. Retention

of the fluid in the sac of a hydrocele is due to the tunica vaginalis remaining open at its lower portion while the upper portion is closed. Sometimes the closure is not complete and a very small opening persists, through which the fluid may be made to pass very slowly. In children the fluid is usually limpid and serous in character.

Hydrocele is often mistaken for scrotal hernia, and not infrequently hernia may be accompanied by an encysted hydro-

FIG. 103.—Transillumination of the scrotum in examining for hydrocele. The surgeon uses a tube to cut off the side light. The same method may be employed in examining cephalocele.

cele of the cord which can not be reduced into the abdomen with the gut. Occasionally also some confusion in the diagnosis may arise from the fact that in a hydrocele that extends up to the abdominal rings, a slight cough impulse may be obtained.

The surest method of diagnosis is by transillumination. The surgeon examines the enlargement through a tube placed against one side of the distended scrotum, while on the opposite side is held a light as shown in the cut. In case of a

hernia the mass is opaque. In hydrocele the pinkish light shows readily through the fluid. Also the tensely distended scrotum in hydrocele has a very different feel from a hernia. In a hernia containing intestine, resonance may be elicited on percussion, while in the case of hydrocele the sound is perfectly flat. In children the treatment is usually simple. Many cases are cured spontaneously. Rhododendron internally will cause it to disappear in many idiopathic cases. Where it is tubercular the inunction of iodoform as described in the article on tubercular peritonitis should be tried.

Conservative methods failing, aspiration of the fluid and injection of pure carbolic acid into the sac should be tried. This is probably the most successful of all methods of treatment of hydrocele, and it is highly improbable that the more radical open methods of treatment are ever required in children.

First, the fluid is drawn off through a small sized short canula. All of the fluid should be pressed out. Of course, care should be taken when puncturing, not to injure the testicle, which is usually found in the lower posterior portion of the scrotum.

After the fluid has been entirely withdrawn, a few drops of pure carbolic acid may be injected into the sac by passing a long hypodermic needle down through the canula, which has been retained in position. The canula and needle are then quickly withdrawn, leaving the carbolic acid in the sac. A general anæsthetic may be required for a child.

Before introducing the carbolic acid, the skin around the puncture should be covered thickly with vaseline to protect it in case any of the acid escapes.

The sac may fill up again but resorption of the fluid usually takes place quickly or it may be drawn off and will not reaccumulate. The patient should be kept quiet for one day after the operation.

UNDESCENDED TESTICLE.

Normally the testicle descends from the abdomen into the scrotum at the end of the seventh month of fœtal life. In from 10 to 20 per cent. of male children it is retained at birth, but may descend during the next few weeks. But no anxiety need be felt if it does not descend before the end of the first year.

If it is not in its proper position at the end of that time it will probably require an operation, although some cases are on record where it has come down much later. (Keyes's Genito-Urinary Diseases.)

Where both testicles are retained in the abdomen the condition is known as *cryptorchism*. Where only one is retained it is known as *mon-orchism*. In some cases the testicles are entirely absent, and this condition is called *anorchism;* but it can only be diagnosed from cryptorchism by operation.

If both testicles remain undescended they may atrophy early in life and the person becomes eunuchoid. He fails to develop masculine qualities, the penis is small, the pubic hair thin, the voice is boyish, and the manner effeminate. Coitus may be possible, but the discharge is small. It has been a matter of dispute whether cryptorchids are always sterile or not, but it is believed to be satisfactorily settled now that they are not always so. (Keyes's G. U. Dis., p. 709.)

The testicle may remain in the abdomen or it may be arrested in any portion of its course to the scrotum. It may sometimes be felt on the inguinal canal, and it is frequently found in connection with an inguinal hernia and sometimes with hydrocele.

The causes are, imperfect development and peritoneal adhesions between the testicle and the bladder, intestines or the aponeurosis of the external oblique.

The effect of retention on the testicle itself is to cause it to atrophy, and it is generally conceded that malignant degeneration is likely to follow. Neuralgic pains may arise from the pressure.

The scrotum is usually rudimentary and contracted and empty on one or both sides. The testicle may be detected sometimes in the upper part of the scrotum or in the inguinal canal. If it is very movable it will probably descend later. (Bramann, in v. Bergmann-Bull.)

Where a hernia is present it may be detected by the usual signs, *i. e.*, cough impulse, disappearance on lying down and reappearance on standing or straining. If the testicle can be felt, pressure upon it gives rise to the characteristic sickening sensation.

"In cases of complete cryptorchism in which neither the testicle nor the vaginal process has entered the inguinal canal, and the testicle is more or less protected behind the abdominal wall, no treatment is indicated." (Bramann, v. Bergmann-Bull.)

The same advice may apply in a case of monorchism where the position of the testicle as described above; but where the testicle is in any portion of the inguinal canal, and especially if it is complicated with hernia, an operation to bring the testicle down into the scrotum if possible and to radically cure the hernia should be performed. Broca performed orchidopexy, or fastening the testicle into the scrotum, 158 times. In only one case was he obliged to castrate. His operations were all done on young boys, and to that fact his success is ascribed.

In operating, if a hernia is not present, the tissues over the

testicle should be split down to the scrotum. The scrotum should be opened sufficiently to receive the gland, which should be carefully freed from all its retaining bands but without injury to the cord. Then the testicle should be fastened with one or two stitches to the scrotum, and, if necessary, a stitch or two should be passed into the substance of the vas without encroaching on its lumen and there fastened to the edge of the aponeurosis of the external oblique. Then the surrounding tissues are stitched closely about the cord in order to prevent its retraction.

In some cases where it is possible, much may be done by the use of a pad or inverted U shaped truss to make traction on the cord, and gradually stretch it sufficiently to bring the testicle down into the scrotum. In some cases frequent and persistent manual traction may produce the same result.

When hernia exists in connection with the undescended testicle a modified Bassini's operation should be performed. The modification consists in not transplanting the cord on a floor made up of the internal oblique and transversalis muscles, but in allowing it to emerge at the lowest point. In this way the whole length of the cord is used to its best advantage. (Coley and Bull, Two Thousand Operations for Hernia.)

VULVO-VAGINITIS IN CHILDREN.

BY ADDISONE S. BOYCE, M. D.

Inflammation of the vulva and vagina in infants and children is a very common affection. The condition may vary in severity from a mild chronic catarrh to an acute vulvo-vaginitis attended with redness, heat, swelling, pain and a copious excoriating discharge. This affection is generally observed in little girls between the ages of 3 and 9, although it is by no means rare in infants and older children. The inflammation may be simple catarrhal or gonorrhœal.

ETIOLOGY.—The common causes of the catarrhal form are lack of cleanliness, exposure to cold and as a consequence of scarlatina and measles. Acute attacks are often excited by the ascarides passing from the rectum to the vulva and vagina, exciting intense itching, which causes the patient to scratch the parts. Masturbation, enuresis and hyperacid urine are frequent causes.

In the gonorrhœal form the gonococcus is responsible. The use of towels and bed linen of those under treatment for gonorrhœa is often the cause of specific vaginitis in children. The trouble may originate from a purulent ophthalmia, although the latter is generally considered an accidental complication of the former.

In 1907 one of the house physicians of the Woman's Hospital reported a case of specific vulvo-vaginitis in an infant two weeks old. The labia were red and swollen, the buttocks and inner surface of the thighs excoriated. There was a profuse purulent discharge which stained the diaper yellow. Microscopical examination of the discharge from both mother and child showed the presence of the gonoccoccus. There was no ophthalmia.

TREATMENT.—The parts should be frequently bathed with warm water and a copious and carefully administered hot douche should be given three times a day. A soft rubber catheter may be used for this purpose.

The injection of 1 dram of 10 per cent. argyrol following the douche of hot water, bichloride, 1-10,000, or carbolic, 1-100, has given very satisfactory results. Injections of a quart of 1-3,000 permanganate of potash, three times a day, have been of great value. Such astringent injections as tannin or alum solution (5 per cent.) or nitrate of silver, 1 per cent., are efficient and have their uses.

Because of the discomfort caused in acute cases by the urine and friction, it is well to apply a protective ointment to the vulva and inner surfaces of the thighs. The child should be examined for the presence of pin worms, and in an aggravated and persistent case, self-abuse as a cause must not be forgotton.

In the purulent form caution should be observed as to the infectious nature of the discharge and the danger of ophthalmia.

RACHITIS OR RICKETS.

Rachitis is a condition of imperfect nutrition occurring during the first two or three years of life. It is the result of improper diet and unhealthy environment.

It occurs more frequently among bottle fed children, but may be found in children who are nursed too long. Prolonged gastro-intestinal catarrh may induce rickets. The failure to maintain a proper balance between the fats and proteids and carbohydrates or the imperfect assimilation of the food is the cause of the disease, and results in an insufficient deposit of mineral matter in the bones.

The bones are soft, and there is an undue increase of cartilage in the epiphises, which become enlarged. The bones bend easily, and unless corrected they harden in the deformed condition. The distortion may be very great and affect only one or two long bones, or, in addition the ribs, the pelvis and the spine. The fontanelles remain long open, the liver and spleen are enlarged, and the thymus gland is atrophied. It is considered by Mendel that the disease is due to the atrophy of the thymus.

Evidences of rickets (Da Costa). "The condition is one of general ill health; the child is ill nourished, pallid, flabby; it has a tumid belly, and suffers from attacks of diarrhœa and sick stomach; it is disinclined to exertion, and has a capricious appetite; it is liable to night sweats, enlarged glands are often noted, the teeth appear behind time, and the fontanelles close late. * * * In rickets the anterior fontanelle is often open when the child is three years of age. The suture is often open at the end of the first year. The head is square in shape, the cranial bones are thick and areas of thickening known as

bosses appear over the parietal bones. The head is large and the forehead bulges. The long bones become much curved, the upper part of the chest sinks in, curvature of the spine appears and the pelvis is distorted. The ligaments are relaxed and lengthened and the joints are wobbly. The muscles are feeble and ill developed.

"Infantile convulsions are common. Nocturnal restlessness and night terrors are the rule. Laryngismus stridulus and tetany may occur. Swelling appears in the articular heads of long bones by the side of the epiphyseal cartilages, and the sternal ends of the ribs, forming in the latter case *rachitic beads*. The lesions of rickets are due to the imperfect ossification of the animal matter which is prepared for bone formation, and the soft bones gradually bend. The swellings at the articular heads are due to pressure forcing out the soft bones into rings.

"Rachitic children rarely grow to full size, and the disease is responsible for many dwarfs. Most cases recover without distinct deformity, but the time lost when active development should have gone on cannot be made up, and some slight deficiency is sure to remain.

"Bow-legs, knock-knees, spinal curvatures are usually rachitic in origin. The disease may be associated with scurvy, inherited syphilis, or tuberculosis. In appearance the rickety child is pot-bellied, pale and anæmic, and usually fat and flabby, though occasionally thin. There is great liability to enlargement of the tonsils, gastro-intestinal catarrh, and bronchial catarrh. The blood is deficient in red corpuscles, and hæmoglobin and sometimes there is leucocytosis. The disease lasts for many months and is usually recovered from. It does not directly produce death, but is a powerful indirect cause of infant mortality, because it lessens the resistance and predis-

poses to many diseases. It is almost always afebrile, rarely congenital, and in unusual cases known as late rickets, develops between the fifth and tenth year.

"The so-called acute rickets is practically always scurvy (Holt). The victims of rickets are very liable to fracture the bones from slight force, and green stick fractures are particularly prone to occur. After fracture of a rickety bone union is usually delayed."

FIG. 104.—Infantile rickets, showing bossy frontals, lateral thoracic grooves and "rachitic rosary," large abdomen and deformities of extremities. (Young.)

I have inserted this lengthy but excellent quotation because it gives such a good picture of the disease which affords in its results a large contribution to the subjects for orthopædic surgery. If possible, the effects of the disease, *i. e.*, the distortions which result from it, should be prevented before hardening of the bones takes place. Holt is of the opinion that braces are of little use after the child is two years old because

the bones have become firm by that time. In my own practice I have extended the time to four years, and in the cases of bow-legs and knock-knees have seen decided benefit from the use of braces. After that time operation must be resorted to by use of the chisel or osteoclast.

One thing must always be remembered and that is the possibility of delayed union of the severed bone. In one case where I chiseled through the tibia, healing of the bones was delayed for many months, although a secondary operation was made and the ends of the bones wired together.

The medical treatment should, of course, aim to the improvement of the nutrition and hygienic conditions of the patient.

APOPHYSITIS IN GROWING CHILDREN

In view of the fact that pains in children are classed under the domestic diagnosis of "growing pains," and that the real cause is often not appreciated, the following clipping from the editorial notes of the Medical Record of December 7, 1907, are of value and I give it in full:

"In any child who complains of his knee, or heel, or spine, the last thing usually thought of is apophysitis. It is always difficult to diagnose it from tuberculosis, as the age of the patient, the slow appearance of symptoms, variations in the pain, and its increase after walking, are symptoms common to both diseases. An exact diagnosis, however, is important from the point of view of treatment, and therefore cases of apophysary osteitis are of undoubted practical interest. In *La Presse Medicale* (No. 34, 1907), R. Romme contributes an article on this subject. His patients were anywhere from nine to eighteen

years old, owing to the different time of ossification; the most frequent cases were those involving the anterior tuberosity of the tibia. He describes tibial apophysitis as beginning suddenly with pain of variable intensity, but sometimes very acute, in one or both knees. On palpation the pain is found strictly localized to the anterior tuberosity, which is felt to be thickened. General symptoms are absent unless the condition instead of remaining a hypertrophic osteitis leading to the formation of a hyperostosis, should begin to suppurate. Tibial apophysitis is easy to diagnose, but diagnosis is extremely difficult when the disease affects the posterior part of the os calcis. In this case the patient may have been lame for some time with pain at the back of the heel; some improvement may follow rest and the administration of sodium salicylate, but the pain and lameness reappear, and now the posterior third of the bone is found enlarged and tender at the insertion of the tendo Achillis. Usually the other side is also affected, but to a less degree. It differs from tuberculosis of the os calcis, inasmuch as the latter usually occupies the anterior third of the bone, does not lead to bony hypertrophy, and is generally unilateral. The diagnosis of vertebral apophysitis is more easy. An abnormal and painful swelling is formed by the hypertrophied tuberosity of the spinous apophysis of the vertebra, the pain is strictly localized; the absence of contraction and curvature is sufficient to eliminate Pott's disease. The treatment of all forms is simple, rest with counter-irritants generally being sufficient to bring about a quick recovery, unless the apophysitis suppurates, when incision and curettage becomes necessary.

OSTEOMYELITIS.

"Acute osteomyelitis is an acute and diffuse inflammation of the bone marrow due to pyogenic organisms." (Da Costa.)

The infection may arise from the presence of streptococci or of staphylococci, or of a mixture of one of these organisms with the specific organisms of other diseases, as typhoid fever, tuberculosis, or gonorrhœa. Usually there is some predisposing cause, something which lowers the vital resistance of the marrow to infection, as any of the exanthematous diseases, malarial fever, diphtheria, poor food, over-exertion, local injuries or sudden chilling of the surface by exposure to draughts or sudden immersion, while over-heated, in cold water.

The pyogenic organisms may gain entrance to the system in any of the ordinary ways through food or drink, injuries to the surface, as fractures, especially compound, and be carried along in the blood current until they find a lodgment at some point of diminished resistance, where they set up an active and destructive inflammation. This inflammation is more destructive than when it occurs in soft tissues on account of the limitation of expansion by the enclosing bone. This limitation of expansion leads to thrombosis of the vessels, cutting off the nutrition from the bone and consequent rapid necrosis.

There is one form of osteomyelitis which most frequently occurs in young children, from one to two years of age. It is known as *acute infantile arthritis,* or acute epiphisitis, and does not take its origin in a wound. It may occur in older subjects. It may be preceded by some of the conditions already mentioned or there may be no known cause in a given

case. The points most frequently affected are the lower end of the femur and the upper end of the tibia. Other bones may be the site of the disease. The disease is exceedingly destructive in its results, as I have seen.

Complete separation of the epiphisis of the tibia from the shaft occurred in the case of a young girl where the attending physician had diagnosed the condition as rheumatism. The compact bony tissue is affected secondarily by having its nutrition cut off and large sequestra of necrosed bones may come away as a final result.

The symptoms are often confounded with those of rheumatism, as in the case stated above, but rheumatism affects the joints primarily, while in osteomyelitis the point is affected secondarily, if at all. The symptoms, as a rule, appear suddenly and may come on at night.

There is usually a chill followed by the symptoms of septic fever, and sometimes a diagnosis of typhoid fever is made. Occasionally the course of the disease is so rapid that the patient may die before a diagnosis has been made. An examination into previous history of the patient should be made to see if an injury has been received, or the patient has been suddenly chilled when heated. There is great pain in the bone, followed later by redness, swelling, heat and all the signs of severe localized inflammation.

When pus has formed there is the usual appearance of swelling and œdema over the inflamed area so that it has been mistaken for erysipelas. (Da Costa.)

Fluctuation and spontaneous opening of the abscess will occur later, and considerable sized pieces of bone may be thrown off, although it may be weeks or months before the sequestra are completely separated.

When there is a suspicion of acute osteomyelitis, especially

acute infantile arthritis, it should be watched carefully and in case the symptoms are severe or there appears to be an indication of localized inflammation or tenderness of the bone it will be far safer to make an incision down through the periosteum and either drill or chisel through the shell of bone into the medullary space. This may have to be curetted and irrigated the form which occurs in children, *i. e.*, *acute epiphisitis* or with an antiseptic solution and then drained and dressed with wet antiseptic dressings until the acute inflammatory symptoms have subsided.

During the first stage, or until the symptoms seem to justify operative interference, there is no better local application than thick compresses of creolin and gylcerine in the relative proportion of ten drops to the ounce. But it must be borne in mind that no time should be lost in operating, for delay may cost the patient a limb or even life.

The following remedies may be of great benefit in the early treatment: Rhus, Apis, Merc., Mezereum.

TUBERCULOSIS.

In children, the structures most frequently affected by tuberculosis where it enters into the category of surgical diseases are the bones and joints, the lymphatic glands, the peritoneum and to a limited extent, the meninges.

It hardly seems advisable to enter into an extensive consideration of the general subject of tuberculosis in a work of this character, therefore I shall confine myself to a brief statement of accepted faults.

While it is conceded that almost every individual takes the bacilli of tuberculosis into his system in one way or another, in

food, drink, air or by actual local (inoculation) infection, a majority of these bacilli encounter organisms or fluids which kill them or render them harmless to the individual. Such persons are those whose power of resistance to the invasion of infective germs is high or who have a high *opsonic index*.

On the other hand, those individuals whose *opsonic index* is low, who either by reason of inherited or acquired weakness lack the power to resist and overcome the invading bacilli, or such as by reason of some local injury have some point of diminished resistance to the germs, become infected at first locally, and later perhaps, generally, and finally, succumb to the disease.

Direct transmission of the disease from parent to child is very rare, while the transmission of a condition of weakened vitality is not at all uncommon. In other words, while the actual disease is not inherited, the child does not possess the normal power to resist disease; and it is probable that this diminished resistance is more marked in regard to certain diseases than to others.

There seems to be a curious tendency for this hereditary predisposition to tuberculosis, as affecting the joints particularly, to jump over one or two generations, and often in questioning patients about their family history it will be learned that while the parents have been healthy, a grandparent has died of the disease.

Another curious fact is that while a slight injury to a bone or a joint may produce a point of diminished resistance to tuberculosis, severe injuries and fractures do not.

From a surgical standpoint the bones or joints are the most frequent locations for the development of tuberculosis in children, and as there are certain conditions and symptoms which are common to all tubercularly diseased joints or epiphyses

they will be mentioned here, and only the distinctive symptoms peculiar to each articulation will be considered in discussing the disease as found in each special locality.

The disease may begin either within the joint in the synovial membrane, or external to it in the spongy bone of the epiphysis. It is probable that in a large proportion of cases a point of diminished resistance is established as the result of a local injury. The history of such an injury may not be obtainable, for either the child may not be able to tell of it or soon forgets having received it. Often, too, it happens that a careless or mendacious nurse refuses to admit that the child has met with an injury while in her charge. As a rule, the parents will believe the nurse in her denial, even if some well meaning person reports having seen the child hurt.

A case came under my care fourteen years ago when a child a year and one-half old had developed well marked Pott's disease of the cervico-dorsal region. The family history was free from taint of disease. No history of injury could be elicited from the nurse who had been with the child from its early infancy. Two years afterwards, however, the mother happened to meet a lady who had been a fellow passenger with her on a trans-Atlantic steamer prior to the development of the disease, and learned from her that during the voyage, the nurse had fallen down the companion way of the steamer with the baby in her arms, and had never told the mother of the accident.

It is probable that children sustain slight injuries with far greater frequency than the parents suspect, and from these slight and soon forgotten injuries a small clot or extravasation results, which blocks up a limited circulatory area and affording a lodgment for bacilli, furnishes the ideal spot with the necessary warmth, moisture and nutriment for their development.

If the colony of bacilli is established within the epiphysis it may be followed by destruction of the bony tissue, caseation and the formation of a cold abscess which will invade the joint and finally appear on the surface.

Its progress is slow and need not be accompanied by fever unless there occurs infection with pyogenic bacteria which changes the mixture of caseous matter and serum into pus. In the treatment of a case every effort should be made to prevent this occurrence.

In case the disease is arrested before caseation and softening take place, the tubercular focus may become incapsulated and the bacilli die, or remain latent for a long period, when from some cause they may be re-excited into activity or be released and disseminated through the system. Sclerosis of the tubercular deposit may occur or even calcification.

In some cases, especially in Pott's disease of the spine, there may be a considerable absorption of bone and resulting deformity without the presence of liquid; this has been called "dry caries."

In some cases the disease first attacks the synovial membrane, which becomes swollen and infiltrated and finally breaks down. The joint capsule is distended with fluid, the cartilages are eroded and the underlying bone is attacked secondarily.

In either case, whether the disease begins originally in the epiphysis or in the joint, if fluid accumulates its tendency is to come to the surface and find an exit. If this occurs infection by pyogenic organisms is almost sure to occur, and the patient suffers not only from the tubercular disease, but also from sepsis. For this reason it is inadvisable to open a tubercular abscess by incision if it can be treated by other methods which will be mentioned later.

When a tubercular abscess has been opened its walls collapse

and sinuses leading down to the diseased bone are left which discharge persistently great quantities of pus. This constant drain, and the absorption of septic matter affects the patient constitutionally. He suffers from hectic, loss of appetite, degeneration of the kidneys, and unless the disease is checked general systemic dissemination occurs and the child dies of exhaustion.

If it happens that the disease is checked and the sinuses heal, it is at the expense of a crippled limb and almost always with bony anchylosis of the joint.

Without treatment the anchylosis is always in a bad position on account of the spastic contraction of the muscles about the articulation. The scars which are left after the sinuses have healed are sunken and disfiguring.

In many cases the point of opening is at a distance from the original site of the disease, because the fluid instead of working its way directly to the surface burrows for long distances between the muscles, following along their sheaths until it approaches the surface.

One of the earliest indications of tubercle or any inflammatory disease of the joint or epiphysis is limitation of motion. This is due to the involuntary spasm of all the muscles about the joint, and is a reflex irritation of the nerves controlling these muscles.

This spastic contraction holds the joint in a flexed position. It is entirely involuntary on the part of the patient, who has no power of relaxing, and is an effort on the part of nature to prevent irritation of the part by exercise of function. It need not be accompanied by local pain.

Shrinkage of the tissues, especially on the distal side of a diseased joint, is an early symptom. In the incipient stage of the disease comparative measurements of the two limbs may be

required to determine the shrinkage, but later on it becomes very apparent while the epiphyses appear abnormally thick.

Retardation of growth is a very constant condition, even if fluid is not formed. This may be very marked, and in a case of hip joint disease which has been cured, it may happen that as a final result the affected limb will be an inch or more shorter than the other.

In cured cases of Pott's disease without much deformity the patient's limbs seem abnormally long as compared with the shortened spine.

The pain from a chronically inflamed joint is always worse at night. This is characteristic and is productive of what is known as the "nocturnal cry." This cry is symptomatic. The child falls asleep with the muscles contracted, and holding the limb in the position which prevents motion and consequent functional irritation. As soon as sleep becomes profound, the muscles relax, the inflamed surfaces are impinged upon causing pain, the child cries out, and the muscles are tightened in the old position. The child may not be awakened completely out of sleep, and again relapses into the stage of relaxation when the same thing occurs again. This may happen over and over again during the night, and the child be deprived of the sound and healthful sleep to which he is entitled.

In the treatment of tubercular bone and joint disease certain conditions are essential.

In the first place limitation or suspension of function is of the highest importance. If the function of any part is exercised, hyperæmia of that part is induced, therefore nature always limits the function of an inflamed part no matter where it is.

For this reason as complete rest as possible is essential in the treatment.

Various methods of limiting motion are employed, as keeping the patient in bed with certain forms of fixation apparatus, allowing the patient to go about or be moved about while wearing one of the various forms of ambulatory splints.

This latter method has the advantage of allowing the patient to take exercise in the open air and sunshine, which are also important aids in the treatment of the disease. Good,

FIG. 105.—X-ray stand and tube.

nourishing food, pure water, pure air and sunshine should always be furnished for these tubercular cases.

Cod liver oil in some form is always good. Most tubercular children take it readily, and often the pure oil. Where they do not, butter given freely with the food, cream, smoked bacon which contains a certain amount of creosote, as well as the fat. Cream in any form is good. In some cases, following Frothergill's hint, I have given some form of butter scotch or taffy, always after meals, and have seen beneficial results follow.

These patients are apt to be capricious and like one article of diet only for a short time, and constant changes may be required to keep up their nutrition.

Such remedies as Silicea, Asafœtida, Tuberculinum. The calcareas are useful.

The agglutination tests of Arlong and Courmont for tuberculosis may be tried for purposes of prognosis, although as stated by Dr. George F. Laidlaw (Academy of Pathological Science, N. Y., March 27, 1908), they are of no value for diagnosis. Injections of tuberculin or of emulsions of trituration of dried, dead bacilli, highly diluted and at considerable intervals (six weeks or two or three months), are often followed by most excellent results.

The treatment of tubercular abscesses is given in another chapter largely as it was written for the Homœopathic Textbook of Surgery.

The detection of tubercular foci in the very early stages of the disease has been made much more easy and certain by the use of the X-ray.

TUBERCULAR PERITONITIS.

This disease occurs occasionally in children, and within the past eighteen months two cases have come under my care.

The first case was a young girl of fifteen who was brought to me at the New York Medical College and Hospital for Women on account of non-appearance of the menses and also because of the enlargement of the abdomen. The girl was not unusually thin at the time of admission, although she was of delicate appearance. Marked dullness was evident at the lower part of the abdomen, but no distinct fluctuation could be elicit-

ed. The dullness changed location from day to day, probably because the ascitic fluid flowed slowly between adherent intestines, from one portion of the abdomen to another. Her family history was bad, her mother having died from consumption. As her surroundings were poor and food insufficient, she was kept in the hospital. The abdomen enlarged and she developed a temperature at night. The diagnosis of tubercular peritonitis was made, but it was not clear that an ovarian tumor did not exist at the same time, and I attempted to make an exploratory incision to clear the diagnosis and at the same time to obtain the well known curative effect of exposure of the peritoneum.

After dividing the superficial layers I found the peritoneum greatly thickened and intensely red and so adherent to everything underneath it that no attempt was made to separate it, and the wound was closed up.

The wound healed immediately, but the enlargement persisted, and as soon as the sutures were removed the iodoform treatment, which will be mentioned later, was instituted. The enlargement of the abdomen diminished rapidly, her health and strength improved, and when I saw her several months afterwards she seemed well.

The other case was one of a boy of five years who had Pott's disease of the spine, and had been operated on by Dr. F. H. Boynton for tubercular mastoiditis with resulting cure of the disease in that location.

Later, his abdomen became enlarged and free ascitic fluid was easily made out. He had no fever, but the distension was uncomfortable, especially as he was wearing a brace. He also suffered from flatulent indigestion.

Under the same treatment the distension entirely disappeared. I have related these cases because they occurred in

children, and also because they represent two different phases of the disease.

Probably in the first case infection took place through the intestines, but there was a predisposition to the disease inherited from the mother. It also developed the adhesive form where there is a tendency for adhesive bands to form between the different organs, while the fluid which collected in the spaces flowed slowly through the imperfect dams. Also she developed more marked constitutional symptoms.

In the second case there is no doubt that the peritoneal disease occurred secondarily to either the spondylitis or mastoiditis. In this case the family history was good and the social and financial standing of the family such that the child had received every attention in the way of care and diet.

There are three forms in which the disease may occur, as the *ascitic* (case two), the *fibrino-plastic* (case one) and the caseous, although it is considered that these are simply different stages of the same disease. The original location in the abdomen may be in the appendix or the mesenteric glands. It seldom occurs primarily in the abdomen, but usually secondary to its development in some other location. If the abdomen is opened in a case of tubercular peritonitis it will be found that the peritoneum is studded with little pearl like bodies, while the peritoneum may have reddish gray color. Deposits of caseous matter may occur and they may soften and break down and discharge into an intestine. The later history of a case will be that of hectic and exhaustion.

Probably the first symptom to be noticed will be a gradual enlargement of the abdomen. In some cases the amount of ascitis is not great. The fluid may be serous, sero-purulent, purulent or sanguinous.

There may be indigestion, nausea, colic, disturbance of the

bowels, weakness and anæmia. Fever may or not be present, but in the later stages it is present and may resemble typhoid.

Tubercular peritonitis is a surgical disease in the fact that the most popular method of treatment is surgical and consists in making a simple incision, opening the abdomen and exposing the peritoneum to the air. No definite length of time of exposure is required. Probably the simple incision and opening of the abdomen is sufficient.

How this cures or why is not known, although much theorizing has been done on the subject. At any rate "It is a curious fact, but one confirmed by ample evidence, that after simple abdominal section without the introduction of germicides and without drainage, at least 30 per cent. of the cases recover from the disease in from six months to a year." (Da Costa.)

Some cases recover spontaneously and others are doubtless greatly hastened towards recovery by proper medication.

My own method, which was employed in the two cases already related, was based on my belief in the efficacy of iodoform as an anti-tuberculous agent. The idea was to get iodoform into a solution in such a form that it could be absorbed by the skin; therefore, I devised the formula, knowing that the etherial solution would mix with olive oil or cod liver oil in any proportion.

℞. Iodoform, ℥j.
Ether, ℥iss.
M.
Add olive oil or cod liver oil, q. s. ℥vj.

Once or twice daily the abdomen should be rubbed for from fifteen minutes or more with this oily solution, and in this form the iodoform seems to be absorbed and probably comes into direct contact with the diseased peritoneum.

I have used the same solution as an injection into the open

sinuses of tubercular joints with beneficial results, and imagine that it might be of service in cases of pulmonary tuberculosis.

TREATMENT OF TUBERCULAR ABSCESSES.

In the treatment of tubercular abscesses three methods are advised by modern orthopædists. First, the conservative method advocated by some authors, which consists in simply leaving it alone, letting it heal up of its own accord, if it will, or allowing it to open spontaneously. These writers seem to care little for a nasty discharging sinus, no matter how disagreeable it may be to the patient and friends, or how bad it may smell. They go on with the hopeful idea that after a while, by the use of mechanical appliances, and, perhaps, internal remedies, the patient may get well. Many cases terminate in this way, but it is after a prolonged period, and with more or less destruction of the joint, shortening of the limb and ankylosis. On the other hand, many of these cases die from exhaustion. Even Bradford and Lovett* incline to conservatism, although in cases where the pus is not completely evacuated by spontaneous opening they advocate the thorough opening and curetting of cavity and sinuses with the hope of being able to clear out the entire diseased portion and get rapid healing.

The radical method, as especially advocated by Phelps, is to make extensive incisions and scrape out all the cavity and sinuses, putting in large drainage tubes to close the cavity as much as possible and get healing by first intention.

*Orthopædic Surgery, Bradford and Lovett, pp. 323-324.

Young,* in speaking of abscesses forming in the cases of tuberculous sacro-iliac disease, says: "When abscesses form they should be freely opened and thoroughly drained, and sequestra found should be removed and the walls thoroughly curetted, the object being to remove, if possible, all tuberculous matter. Drainage is best effected with iodoform gauze and full antiseptic precautions." It would seem that if anything of the above sort is to be done, it must amount to a complete excision and include all the diseased bone.

The third and best method for cold abscesses which have not opened is, to the author's mind, the treatment by injection of a fluid containing iodoform, either in solution or suspension. Of these the ethereal solution is to be preferred. The reasons are: First, only a puncture is made through the skin. This is made aseptically, heals up immediately and does not allow of infection. Second, iodoform is placed in the cavity in such manner that the drug exerts its action directly on the lining of the cavity. The ether soon evaporates, leaving the iodoform in its pure state, which cannot so well occur when the emulsions with oil or glycerine are used. Third, the injections may be begun as early as the abscess presents itself, and there is no radical operation requiring a prolonged stay in bed or necessitating complicated dressings. Even before the abscess is apparent, iodoform in oil may be injected into the capsule of a tuberculous joint or into the tissues about the joint. Fourth, while all cases are not cured the majority are, and much more quickly than by the use of the appliances alone.

Iodoform exerts a specific action upon tuberculous tissues, and many experiments have been made to determine its exact method of action; but exactly what this is has not quite been determined. Of its effects Senn (†), in reviewing the results

*Orthopædic Surgery, Young, p. 62.

†Senn in Tuberculosis of Bones and Joints, p. 249; Idem, 265.

of the researches of Troje and Tangl, says: "Their investigations have led them to the practical conclusion that iodoform is a true disinfecting agent as far as the tubercle bacillus is concerned; that it has a direct destructive effect upon the bacillus if left sufficiently long in contact." Further reviewing the clinical results observed by Bruns and Nauwerk: "They incised tubercular abscesses treated by iodoform injections at different intervals after the injection and extirpated pieces of the abscess wall for microscopical examination. A few weeks after injection they found that the tubercle bacilli had disappeared, the miliary tubercles softened by infiltration with round cells and œdematous inhibition of a serous fluid. Further on the tubercles disappeared by fatty degeneration of the cells and liquefaction of the cellular detritus. Hand-in-hand with the degeneration and liquefaction of the tubercular product could be witnessed in the adjacent tissues a process of repair, in the shape of a wall of granulation tissue, which formed a line of demarkation between the healthy and diseased tissue, which consumed in part the dead, sterile, tubercular tissue and detached the balance. As soon as the dead tissue was disposed of by absorption the granulations began to cicatrize, and were gradually converted into connective tissue, and with this change the process of the healing was completed. Krause made similar examinations and corroborates the observations made by Bruns and Nauwerk. That the curative effect of iodoform in the treatment of tubercular joints and abscesses is not owing to the mere puncture and evacuation, but is brought about by the specific action of iodoform on the tubercular products, there can be no doubt, as tapping for these conditions was employed long before iodoform was used in surgery, but this procedure seldom yielded more than temporary relief."

In conclusion Senn (*) says: "Of all substances now employed in this method of treatment iodoform has yielded the best results. The curative effect of iodoform in the treatment of local tuberculosis is due to its anti-bacillary effect and its stimulating action on the healthy tissues adjacent to the tubercular product."

It is not necessary to quote authorities further, for the literature of the subject is far too extensive. The question now arises: Which is the best method of getting the iodoform in contact with the diseased tissue?

Many writers object to the use of the ethereal solution from fear of danger. It may be that the bad results which have come from the ethereal solution have arisen from an improper method of administration, probably leaving the ether in the cavity and giving no vent. Senn (†) states the accidents which have occurred, and other authors have evidently formed opinions from reading his writings, though without actual experience, as, for instance (‡): "The ethereal solution should never be used, as it is liable to cause necrosis of the over-lying tissue and iodoform intoxication."

The author is not particularly strenuous regarding the exact way in which the iodoform is conveyed into the abscess cavity, provided it gets there and does its work. But in all the cases in which he has used this injection he has never yet had a bad result. He has used it in all sorts of places, as in hip-joint abscesses, cervical abscesses and abscesses from "Pott's disease," which have pointed in various parts of the body. One of them had sinuses in both groins, and the solution could be injected into one groin and would come out the other, the

*Idem, 264-265.

†Transactions Am. Orthop. Assn., 1893, Vol, p. 43.

‡Tuberculosis of Bones and Joints, pp. 262-263.

sinus passing down back of the peritoneum and probably behind both psoas muscles. In another case the abscess had opened spontaneously into the rectum. The sphincter was dilated, a catheter passed up into the sinus and the cavity injected several times, with excellent result. In the place of ether Billroth used glycerine to hold the iodoform in suspension. Olive oil gives better results, and is preferred by most surgeons. But it must be remembered that glycerine and olive oil only hold the powdered iodoform in suspension, while ether holds it in solution. Any one who has dissolved iodoform in ether knows how rapidly the ether evaporates, leaving a perfect coating of iodoform on the surface of everything it has touched.

In order to keep the iodoform in the abscess cavity the oil or glycerine must remain with it. If the ethereal solution is used the ether vaporizes and evaporates rapidly, leaving the pure iodoform in contact with every portion of the cavity. This seems to be a more perfect and thorough method of application than the other, and to avoid any danger from over-distension of the cavity the ether vapor is allowed to escape through the canula.

With the iodoform and the oil injection the cavity is first drained of its contents and then washed out with a four per cent. solution of boracic acid, all the flocculent masses are removed, even if the opening has to be enlarged. Then a ten per cent, emulsion of iodoform in sterilized olive oil is injected, not more than one-half drachm of iodoform being injected at one time.(*) The opening is sealed with a pledget of antiseptic cotton and iodoform collodion. This process may be repeated as often as every two weeks until the case is cured.

In using the ethereal solution as much of the tuberculous

*Senn, Tuberculosis of Bones and Joints, p. 258.

fluid as will flow through the canula is drawn off. If large flocculent masses remain they should not be disturbed. The solution seems to possess a disintegrating effect on them and they will probably come away in the solution at the second tapping.

The method of procedure is as follows: "The parts are thoroughly scrubbed with German green soap and warm water and afterwards rinsed off with corrosive sublimate solution 1-2,000. The aspirator has been previously prepared by boiling. The needle should be made aseptic by passing it through the flame of an alcohol lamp or boiling. The air is exhausted from the receiver and a medium-sized needle attached. This is plunged into the cavity and as much pus as possible drawn off. Frequently the pus is flocculent and will not run, and in such a case it is allowed to remain. Now, as much of the saturated solution of iodoform in sulphuric ether as the cavity will hold is injected through the aspirating needle, from which the rest of the instrument has been detached. This must be done very slowly, as the ether boils at the temperature of the body, and on account of the expansion of the vapor, some injury might be done if proper precautions were not taken. Another and smaller needle should be introduced near the first. This gives a vent and acts as a safety valve. As much ether should be allowed to escape as possible, and its escape may be aided by gentle pressure over the sac.

Often the pus which could not be drawn out by suction is forced out by the ether vapor. The amount injected varies, generally from two to four ounces. When it has been done and the pressure relieved, the skin about the needles is cleansed, the needles rapidly withdrawn and the small orifices quickly sealed up with pieces of O. Z. rubber adhesive plaster. If at any time the tension becomes too great, so that it causes much

pain, the small needle should be inserted and the accumulated vapor allowed to escape. The patient should always be etherized when injecting cold abscess cavities. The operation itself would be very painful without an anæsthetic. After the operation the cavity becomes greatly distended, but after a few days the hardness begins to lessen, and gradually the tumor shrinks away.

It is unnecessary to make an opening with the knife, in order to get rid of the flocculent pus when the ethereal solution is used.

In one case in which this was done, and the opening sewed up, it reopened in a few days at this point, and the progress of this case was much slower than with the others.

Where the abscess has already pointed and broken, of course, the aspirator is not used. The nozzle of the syringe is introduced directly into the sinus, and the fluid injected and retained as long as the patient is able to stand the tension—for in these cases, as a rule, an anæsthetic is not necessary. After the injection a close antiseptic dressing is applied and allowed to remain in place as long as the discharge does not come through.

In cases where there is a very deep cavity left after the spontaneous or artificial opening of an abscess, as in psoas abscesses, a medium-sized English webbing-catheter is introduced down deep into the cavity, and the injection made through that. Sometimes the catheter can be inserted to the depth of eight or ten inches, and the solution comes into contact with every portion of the abscess wall. As a rule, the immediate result has been to diminish the amount of discharge, while, coincident with this, there is a general improvement of all symptoms.

From experiments made on a number of cases at the Laura

Franklin Hospital, the author is of the opinion that cases, where rupture has taken place and where there are sinuses leading to an old abscess cavity, do better under the daily injection of ten per cent. of iodoform in sterilized olive oil. Before the first injection, the cavity and sinuses should be syringed out with a solution of peroxide of hydrogen, but it is not necessary afterwards. This treatment seems to induce healing more rapidly than the ethereal solution.

In closing this chapter the following conclusions should be noted:

Simple "lancing" of a tubercular abscess, without antiseptic precautions and after-treatment, is useless, unscientific and dangerous.

Tapping and iodoformization should always be tried before more radical measures are attempted.

This procedure may be successful in cases where the diseased focus is inaccessible to the knife or curette.

If an operative measure is required let it be a thorough one —accomplishing a complete excision of the diseased portion.

Cases in which the abscesses have not opened are much more amenable to treatment than those which have sinuses leading down to them, although in many of the latter cases good results may be obtained.

The results which have been obtained are unquestionably good, and a large portion of cases of tuberculous bone and joint diseases in the third stage may be cured by the tapping and iodoformization.

Carbolic acid in 5 per cent. solution injected into the cavity and allowed to remain after aspiration of the fluid is advised by Konig. The technic is much the same as where iodoform emulsion is employed.

Bier's treatment of inducing passive congestion by use of a

rubber band above the joint has been employed. The band is applied just tightly enough to keep the distal portion of the limb in a state of passive hyperæmia, but not sufficiently tight to shut off the circulation or cause pain. This treatment is given for twelve to fourteen hours a day.

It is claimed by Bier that this treatment "hastens the formation of fibrous tissue and causes hypertrophy of the bones; it assists in the absorption of the effusion and such newly formed tissue as is liable to prevent joint motion; pain is lessened and joint motion is much freer, and it has a bactercidal effect in infectious joints, particularly tuberculous." (Young, Manual and Atlas of Orthopædic Surgery.)

Full details of the hyperæmic treatment of Bier are given in a work on the subject by Dr. Willy Meyer, of New York, and Dr. Victor Schmieden, of Berlin. Radiotherapy has been advocated, but its value is as yet undertermined.

ORTHOPÆDIC SURGERY.

As mention has been made in the chapter on Tuberculosis, of the pathological conditions, symptoms and general history of tuberculosis of bones and joints it will not be necessary to recite them again when considering the disease as affecting each joint separately. In disease of the spine, hip, knee and ankle the pathological conditions are similar, and the following conditions and symptoms are similar in all, as:

I. Point of attack, either in the joint or epiphyses.

II. Tendency to destruction of joint and more or less of bone, and, if unchecked, to general dissemination of tuberculosis and death from exhaustion.

III. If a cure occurs spontaneously it is at the expense of anchylosis and deformity.

IV. More or less arrest of growth.

V. Frequency of an injury as an exciting cause.

VI. The following symptoms are common to all: Spastic contraction (flexion), pain on motion, nocturnal cry, shrinkage of muscles about joint, swelling, loss of folds and creases about the joint and failure of general health.

POTT'S DISEASE, OR ANGULAR CURVATURE OF THE SPINE.

Pott's disease of the spine is a progressive inflammatory disease of the vertebral bodies or invertebral disks, leading to their partial or complete destruction, usually terminating in ankylosis with the characteristic posterior deformity. (Young.) The disease rarely extends back of the articular

FIG. 106.—Macerated specimen. Entire destruction of a dorsal vertebra.

processes, being confined to the bodies of the vertebræ and to the intervertebral substances.

All of the conditions which enter into the development of tubercular disease in other portions of the body may be present here, but there is such a large area of spongy bone and so

many of the vertebræ may be affected, that the deformity resulting and the actual damage done may be of greater extent than at almost any other portion of the body. The spinal column may be likened to a single column of bricks which supports at its top a considerable weight. If a portion of any one brick or series of bricks is removed it affects the integrity of the entire column so that any weight which is supported above by this column will have a tendency to fall. However, it must be borne in mind that the vertebræ are closely united posteriorly by the ligamentous structures which pass from one spinous process to the other, and that the articular processes also give a certain amount of support, but that the disease, affecting only the bodies of the vertebræ and not extending posteriorly to the articular processes, does not allow of a complete collapse of the column. A limited amount of support is obtained from the articular processes, and the result is that instead of a complete falling over of the column there is only a partial collapse, in consequence of which the spine projects sharply backward, making a prominence posteriorly which gives the name of "angular curvature" to this disease. This becomes increased more or less, according to the portion of the spine which is affected, the deformity arising also being influenced by the same conditions.

The destruction of the vertebra may be confined to only one or perhaps two or three. What is known as the "dry variety," or caries sicca, is exhibited when absorption takes place without the formation of pus, in which usually a larger number of vertebræ are affected. The difference in the two varieties makes a difference in the kind of deformity which follows. In the dry variety several vertebræ are likely to be affected, and the result will be that a large posterior curve will be formed, while in the more acute variety, which is accompanied by sup-

puration, the deformity is more frequently a sharp acute angle than a long curve. As a result of a destructive process in the bodies of the vertebræ the weight above causes them to collapse, and as they give way in front they are held in position posteriorly by the articular processes, which remain unaffected. The result is that there is a caving in in the anterior portion of the vertebral column, while the spinous processes project backward into a more or less acute angle. In the dry variety there is absorption of the diseased portions without the formation of an abscess, while in the ordinary variety there is usually the formation of a tubercular abscess which seeks an exit through some portion of the surface of the body. Sometimes in connection with the disease of the bone there may be meningitis or even a myelitis of the cord; but ordinarily this is not the case, the condition which usually affects the spinal cord being what is known as an external pachymeningitis. This inflammation may cause compression of the cord to such a degree that its function is lost at the point below the pressure, and may result in paralysis of the limbs or of the bladder and rectum. As a rule, the disease does not directly affect the cord itself or the meninges, but is confined, as before stated, to parts external to them. The shape of the chest is also affected and its capacity limited. In many cases there are affections of the heart; in some cases displacement, cardiac hypertrophy, valvular lesions, and, frequently, phthisis pulmonalis being the final result.

In spite of any form of retentive treatment the kyphosis will sometimes increase. This is due to the spastic contraction of the muscles anterior to the spine, which, as in all cases of bone or joint disease, tend to flex the point, and in the spine flexion means increase of the concavity anteriorly.

The disease is about equally prevalent in both sexes, and

most frequently found in children from the first to the fifth year, and next from the fifth to the fourteenth year, although in some cases it is found even later. One of the exciting causes which has been laid down is the upright position. Animals do not develop disease of the spine because they are not subject to the same conditions which come from pressure on the vertebræ from the superincumbent weight. The most frequent locality is in the dorsal vertebræ.

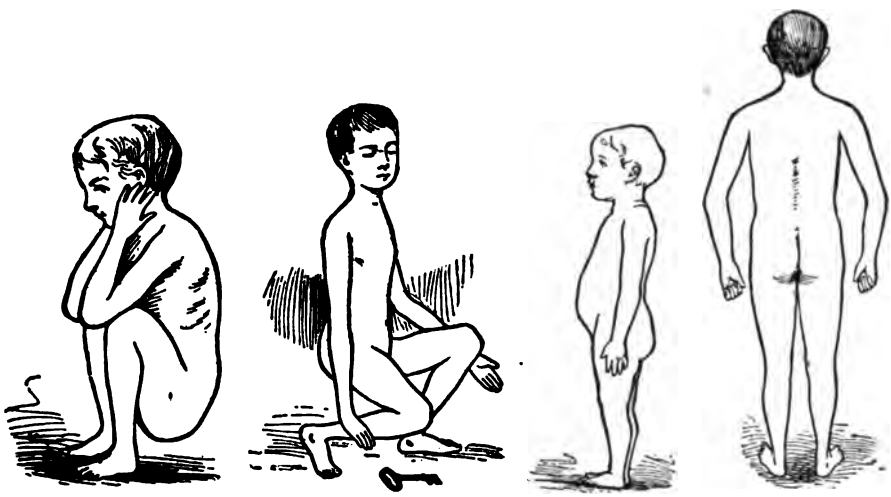


Fig. 107. Fig. 108. Fig. 109. Fig. 110.

Attitudes illustrating muscular rigidity.

SYMPTOMS.—The symptoms in cases of Pott's disease show similarity to those of diseases in the bone in other portions of the body. Where there has been an accident to which the disease can be traced the symptoms are introduced from the first, but in the great majority of cases it happens that there is no accident to which the disease can be directly traced, and in such cases there may be a prodromal stage in which the child exhibits a condition of malaise in which he is less active than usual, and appears to be in a condition of poor health. There

is stiffness and difficulty of getting about in the morning, the child appearing to improve as the day goes on, such symptoms being frequently mistaken for rheumatism.

Frequently the symptoms do not appear at the point of the disease, but more likely at some other than the directly affected part. This is due to the irritation of the roots of the nerves as they pass from the spinal column; but the pain being referred to the distal portion of the nerve the patient may suffer from a hacking cough, pain in the stomach, or pain in other portions

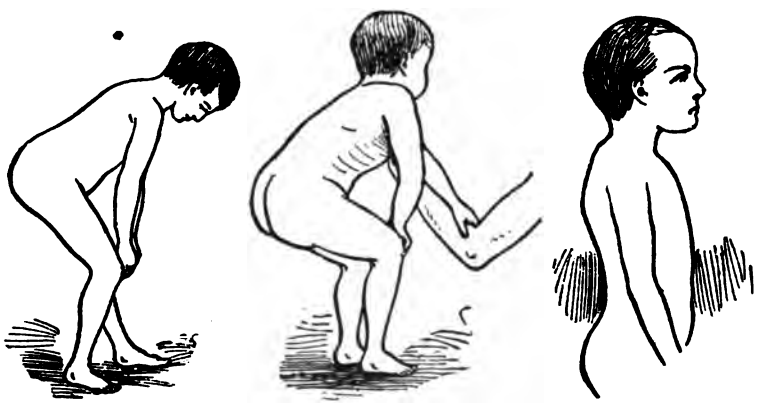


FIG. 111. FIG. 112. FIG. 113.
Attitudes illustrating muscular rigidity.

of the body before the actual disease is discovered, so that the child is frequently treated for conditions which do not exist. The reflex pains may vary according to the portion of the spine which is affected. If the disease is in the cervical vertebræ there may be such symptoms as difficulty in swallowing, perhaps in constant hacking cough, or the sensation of a cord tied about the neck. If it occurs lower down there may be the cough or symptoms referred to the stomach, and the child is frequently treated for indigestion. There may also be the girdle pain about the chest and body

which is characteristic of the disease and which comes from spasm of the diaphragm, the patient finding it difficult to take a long breath on account of this pain. There may also be symptoms referred to the lower portion of the body, symptoms referable to the rectum, bladder, lower limbs and abdomen, with more or less paralysis of these organs and, perhaps, paralysis of the limbs. Often much valuable time is lost in the early stages of the disease through not recognizing the real source. There are also the symptoms which accompany any form of chronic bone disease. The child may have pain at night, with the osteitic cry, and sudden waking up and screaming. This symptom is not always present, though very frequently it is one of the distressing symptoms which accompany the disease.

The most marked and most diagnostic symptom is muscular rigidity. This is evidenced by the rigid position in which the child holds himself when attempting the upright position, shown by the attitude which is assumed by the patient which is almost diagnostic in itself. Of course, some variation is found according to the location of the disease, but, as a rule, certain conditions may be found in whatever portion of the spine it occurs. On account of the pain which is caused by any attempt to move the spinal column, the patient maintains it in a rigid position. There is also the reflex spastic contraction of the muscles of the spine which accompanies any form of bone disease. As a result of this voluntary and involuntary contraction of the muscles any attempt to change the position is made with the spine held as rigid as possible, so that when the patient turns about, instead of moving the head and neck he turns the whole body at once. In stooping to pick an object from the floor, instead of bending forward as a well child would do, he places his hands on his thighs, flexes the hips and

knees so that he reaches the floor in a squatting position, but with the spine as nearly straight as possible. This is shown in the illustrations, Figs. 107 to 113.

There is a peculiar position in which the head is held with the chin thrown forward and prominent, and shoulders elevated; the patient is always very slow and deliberate in his movements, and in walking about will always attempt to support the weight of the body by placing his hands on a chair, on his hips, or on articles of furniture about the room. The object of this is to relieve the pressure on the diseased vertebræ and to raise the superincumbent weight from the point of disease. All of these symptoms are to be taken into consideration in making examination of the patient, and if an angle or knuckle is found along the spinal column it adds to the certainty of diagnosis of Pott's disease. The patient soon begins to show signs of chronic invalidism, the loss of sleep tells on his constitution, the constant pain and diminished appetite cause him to grow thin, he becomes irritable, does not wish to move; in fact, any motion is accompanied by cries and groans.

As a result of the spastic contraction of the muscles and also on account of the pain which is caused by the movements of the chest, the respiration is frequently very much impeded, so that the child, instead of breathing in the ordinary free manner, emits a grunting sound. The chest is held as rigid as possible and the excursion of the ribs is limited. Paralysis may come on early or late, generally late, although in some cases it precedes the deformity. It usually affects both sides and may vary in degree from slight limitation of function to complete paralysis of all portions below the waist. This is also accompanied by wasting of the muscles. There may be spastic contractions of the psoas muscle to so great a degree as to prevent the child from standing. In some cases there is great weak-

ness of the limbs, which may be wasted, but the reflexes are normal, thus differing from compression myelitis. Deformity is the most characteristic symptom. The projection of the spinous processes backward depends upon the amount of injury to the spine. The trunk becomes shortened and the limbs appear disproportionately long. If it is in the upper portion of the body, the head sinks between the shoulders so that the peculiar deformity of the anterior portion of the chest known as "pigeon breast" is very marked. Where the disease is accompanied by the formation of pus the angle is an acute one,

FIG. 114.—Attitude and characteristic expression in retro-pharyngeal abscess.

but where there is a long posterior deformity it is usually the result of the dry variety of caries. The presence of an abscess is determined by its appearance upon some of the surfaces of the body. If the disease progresses there may be the formation of the peculiar feature of the disease known as "psoas abscess," in which the pus burrows down along the fascia of the psoas muscle and perhaps upon the surface of the thigh at a long distance from the focus of the disease. But the abscess is not by any means limited to this region; it may point in any place. Sometimes, if it occurs high up in the column, there is

a retro-pharyngeal abscess which may open into the pharynx, burst into larger bronchi, or point and break on the back; or sometimes, though infrequently, it opens into the intestinal canal.

The most frequent variety, however, is the "psoas abscess" before mentioned, which contains the liquid and debris resulting from tubercular disease. When the disease has progressed

FIG. 115.—Psoas Abscess.

to this stage it is known as the stage of abscess; the symptoms are marked, the patient becomes emaciated, perhaps totally incapacitated, and may die from exhaustion, from amyloid degeneration of the kidneys or pulmonary tuberculosis. Sometimes the abscess, or rather the fluid portion of the abscess, undergoes absorption, the solid contents become encysted and

may remain without giving rise to further disturbance. The general condition of the patient depends largely upon the extent of the disease. The child is likely to be fretful, capricious, often precocious, delicate, takes cold easily, suffers from attacks of indigestion, temperature is higher than in health, in the later stages he suffers from hectic, and is liable to tubercular meningitis.

In the examination of a child, in the early stages where the disease is suspected, all the symptoms before detailed should be taken into consideration. The child should be stripped and carefully examined for any prominence of the spine. He should be made to stoop and pick something from the floor; he should be required to walk about and to attempt various motions, to determine whether the column is rigid or not. An examination should be made as to the flexibility of the spine. The child should be laid flat, face downward, on a table while the surgeon places his hand on the child's back, and grasps both feet in the other hand, raising them from the table and attempting to flex the spine backward as far as possible. If the vertebræ are inflamed the column will be retained in a rigid position, and it will be found that only very slight flexion or none at all, can be obtained, and that the patient comes up stiff from his hips to his shoulders. On the contrary, if there is no disease present there will be very marked flexibility of the spinal column so that there is a decided curve as the limbs are raised from the table. Suspension should also be tried. The patient should be placed in the Sayre apparatus, or should be lifted by his head as far as possible, if not entirely off the floor, so that the entire weight may depend from head and shoulders. This usually gives immediate relief from pain.

If the patient has been suffering from difficulty of respiration one marked feature may be the relief experienced from

suspension. Where, before the suspension, the patient's breathing was accompanied by a grunting sound, when he is suspended the breathing becomes free and easy and he evinces signs of relief. This is explained by the fact that the pressure is taken off the inflamed vertebræ, and as it is removed the patient is relieved of the aggravation caused by each excursion of the ribs and shows it by his easier breathing, and frequently by stopping the crying or shrieking which has accompanied the previous part of the examination. The patient should also

FIG. 116.—Varieties of lumbar abscess.

stand on a chair or table and slight pressure be made downward on the top of the head to see if the pain is increased or not. Pressure should be made on the ribs to ascertain if they articulate with the inflamed vertebræ; if they do, this will cause pain at the junction of the ribs and the vertebræ. Where greater progress of the disease has been made and deformity is present the diagnosis is easy. The diagnostic points which are given in connection with hip joint disease, for diagnosing between disease of the lower vertebræ and disease of the hip joint by examination of the flexibility about the joint, should

also be carefully tested. The surgeon must be careful in making a diagnosis to eliminate tumors, when the history and physical signs will generally be sufficient to lead one to a correct differentiation. Empyema will be distinguished by physical signs, the history and local symptoms. When abscess is present and in the inguinal region it has some points in common with the inguinal hernia. The presence of a tumor at the usual point of a hernia with the cough impulse may lead one to suspect that this condition may be present; but other symptoms, and especially the history of previous Pott's disease, will lead to a correct decision.

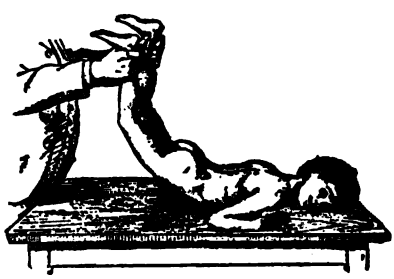


FIG. 117.
Flexibility of normal spine.

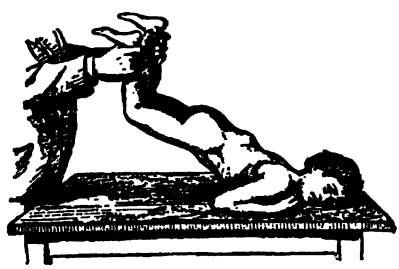


FIG. 118.
Rigidity of diseased spine.

A large number of cases of Pott's disease of the spine get well spontaneously, but there is likely to be deformity of very marked degree, and the object of treatment is not only to decrease the proportion of mortality, but to prevent as far as possible the deformity from becoming progressive, and also to save the patient the severe pain which accompanies the course of the disease. It is probable that under proper treatment the severe varieties of deformity can be prevented. More or less deformity may necessarily accompany the absorption or disintegration of the bodies of one or more vertebræ, but hunchback and severe forms of angular curvature may be avoided. If the patient recovers, there may be ossification of the diseased

portion and complete ankylosis of several vertebræ; if an abscess is present it may end in a residual abscess and finally undergo calcification.

TREATMENT.—In the treatment of these cases the first thing is to relieve the pain from which the patient suffers, and the easiest and quickest way to accomplish this is to immobilize the spine. This can be done by means of braces or by one of the various forms of jackets made of plaster of Paris, leather, felt, wood or paper. The most convenient and easiest method is the use of the plaster of Paris jacket, because it is easily applied, is cheap, adapts itself immediately to the form and can be more quickly obtained than any other form of apparatus. The plaster of Paris jacket was reintroduced a number of years ago by Sayre and has been almost universally adopted in the treatment of these diseases, having been found very effectual. For the application of the plaster of Paris jacket the patient should be suspended in the Sayre apparatus sufficiently to take the weight off the spine. In small children they can be suspended so that the feet do not touch the floor, but larger children, where the pressure on the head and under the arms would be too great, may be allowed to balance themselves on their toes (Fig. 119), taking as much pressure as possible off the column. The patient should have a very closefitting knit shirt which will accommodate itself perfectly to all the curves of the body, so that there be no wrinkles, and in order to put it on the stretch weights should be attached to the bottom to draw it down as straight as possible. In the directions given in most works of orthopædic surgery it is stated that a padding over the hips and the prominences should be placed directly against the skin underneath the shirt, but I believe this to be a mistake. If the cotton or wool padding which is used is placed over the shirt and between that and the plaster of Paris bandages it remains

in position and is quite as efficacious as when placed underneath. All prominences should be well guarded, because, in spite of the fact that the jacket may be a perfect fitting one, there will be more or less shifting and the skin is apt to be rubbed away from the bony prominence. If there are abscesses which are discharging at a point where the jacket would cover the opening, provision should be made for the discharge, and if a small piece of cardboard, about two inches in diameter, with a pin sticking through the center, is placed directly over the sinus and left in this position while the bandages are being wrapped around the patient the point of the pin will act as a guide for the finding of the cardboard. In order that the head of the pin may not be driven into the flesh it is well to place another small piece of cardboard between it and the skin. After the jacket has been applied the plaster may be cut away sufficiently for the cardboard to be removed, then the edges of the cut plaster are made waterproof by shellac or a solution of rubber tissue in chloroform, and the discharge caught on some form of dressing and removed as often as necessary. While the patient is suspended, the plaster of Paris rollers are placed in a dish which contains sufficient water to just cover them; only two or three bandages should be placed there at a time, that one or two may be soaking while one is being applied. The surgeon begins at the hips and passes the bandages rapidly round and round the body, each turn of the bandage over-lapping the one which preceded it about two-thirds. Occasionally one or two strips should be made to run diagonally from the shoulder to the opposite hip, or crosswise, to bind the different layers together, because if this is not done the jacket will sometimes split or break in two.

As the bandages are being applied an assistant should rub the plaster well into the bandages so as to firmly knit all

the different layers together, additional plaster being applied from time to time as it may be needed. The advantages of the plaster of Paris jackets are its cheapness, its ease of application, its perfectly fitting shape and its rigidity.

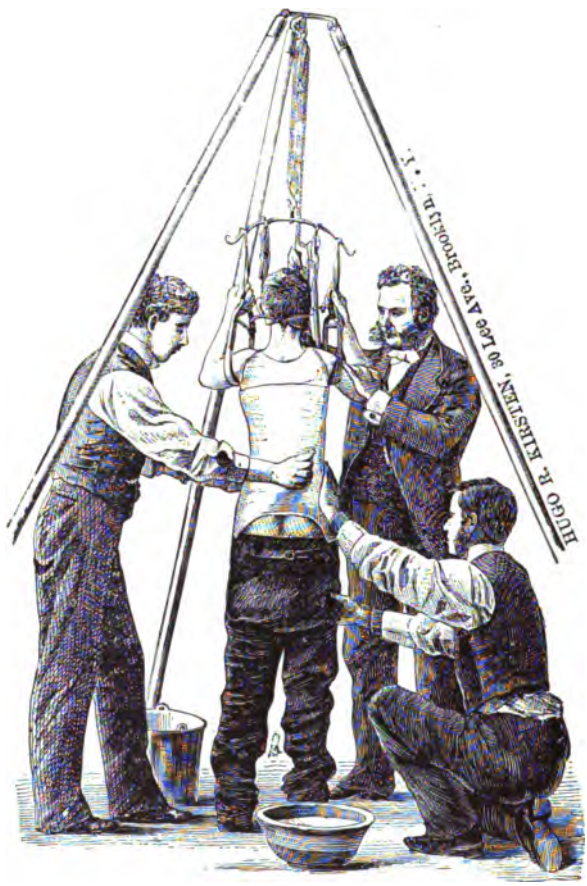


FIG. 119.—Method of applying plaster of Paris jacket.

In case of Pott's disease the plaster of Paris jacket should not be opened, but kept perfectly solid. The object of this is to prevent as far as possible the excursion of the ribs in breathing, maintaining the chest in an immobile position. The patient is

able to breathe sufficiently in the upper portion of the chest and the abdomen so that the movements of the chest are not absolutely requisite. One provision which must always be made is for the increase in size after meals, and for this purpose what is known as a "dinner-pad" is placed underneath the shirt upon the stomach of the patient while the plaster is being applied. This is to be removed during the process of drying.

In some cases it is impossible to suspend the patient for application of the plaster of Paris jacket. In such a case a strip

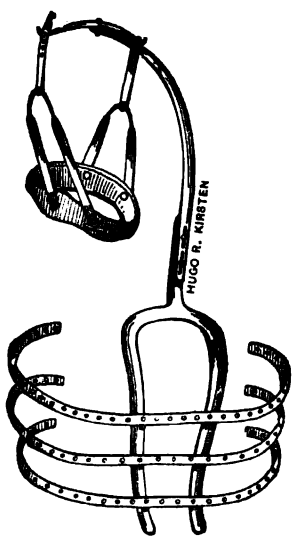


FIG. 120.—Sayre's jurymast.

of strong muslin may be stretched lengthwise over a frame. This should be as long as the patient. The patient is laid flat, face downward, on the muslin, which should then be slit down alongside and close to the body. Then, while the patient is kept in this position, the plaster bandages are wrapped round him, passing through the slits and enclosing the portion of the muslin on which the patient is lying. This procedure is of importance as a last resource. If there is disease in the cer-

vical vertebræ or in the cervico-dorsal region the plaster of Paris jacket does not answer the requirements sufficiently in itself and the surgeon has to add some form of head support, the best of which is the "jurymast." (Fig. 120.) The base of this is embedded in the layers of plaster of Paris during its application, and the curved portion or headpiece may be screwed on afterwards. The plaster of Paris jacket has a few objections. In warm weather it is likely to become soft from perspiration of the patient's body, and on account of not being able to remove it, the secretions from the skin are likely to cause irritation; again, it sometimes becomes exceedingly filthy, especially where the cases are not well taken care of, and it is impossible to clean it effectually.

A strip of gauze may be placed longitudinally under the shirt before the plaster bandages are applied. By drawing it up and down and slipping it around the body a certain amount of cleansing can be done. It may be renewed from time to time by sewing other pieces on to one end and drawing them into place as the first pieces are drawn out. However, it is the only form of apparatus which can be used in some instances. The leather, the rawhide, the paper and the wood corsets have certain objections; they are generally made so that there is very little chance for ventilation, being very close and likely to cause more or less excoriation of the skin unless they are removed quite frequently, and the removal of any form of apparatus is open to serious objections. The felt jacket, which is more porous, is also likely to becomes necessary to use a good deal of will power to overcome author has found more satisfactory results from the use of a modified "Taylor's" brace than any other form of apparatus. This brace is easily applied, the jurymast may be added to it with very little difficulty, and it has the advantage of being

much better ventilated than any of the forms of jacket. It is also lighter, and in my hands has given excellent satisfaction. In some cases I have used a sole leather back attached to the brace. This goes half way round the body and is moulded to a cast taken of the back. Whatever form of treatment is adopted, the immediate object is the complete immobilization of the spine to prevent the functional hyperæmia, diminish the inflammation and secure relief from pain, and these cannot be accomplished without some form of apparatus The forms which have already been mentioned are the most satisfactory.

While the brace is, on the whole, more satisfactory, it requires much greater skill in its application on account of the

FIG. 121.—Hard rubber chin rest with occipital support.

difficulty in shaping it perfectly to the body. In order to do this correctly the surgeon must be an adept in bending the steel bars to make them fit into the depressions and over the prominences. If this is not done perfectly, chafing and ulceration of the skin, with great pain to the patient, will surely result.

For cases of cervical caries some surgeons prefer the hard rubber chin piece, which is attached to the spur of the brace by means of a ball and socket joint, the motion of which may be limited by a set screw. (Fig. 121.)

This device has not been found as comfortable to the patient or as good in its results as the jurymast with the headpiece.

Objections have been made to this latter apparatus, one being that the pressure of the straps on the sides of the face causes the wearer to bite his cheeks when chewing. This has been obviated by the use of a steel spring shown in Fig. 125, which spreads the straps apart, and at the same time keeps up an even traction.

Another improvement which has been added is the arrangement for making traction directly upward from the occiput and under part of the jaw, instead of drawing upward and backward on the chin. This is much more comfortable for the wearer, and is less likely to produce the receding chin frequently the result of long-continued use of the single crossbar.

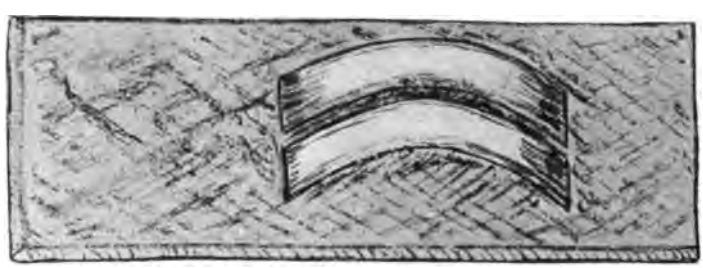


FIG. 122.—Stretcher of canvas or rattan fastened over a frame of gas pipe or wood with padded arches to correct the kyphosis.

The application and removal of the brace with the jurymast is greatly facilitated by the use of detachable shoulder pieces.

In cases where it is not advisable to allow the patient to go about in the upright position a stretcher made of canvas or rattan drawn tightly over an iron frame may be used and the patient strapped tightly on to it. In order to get more pressure on the back and to prevent as far as possible an increase in the kyphosis two padded steel bars each about two inches in width are fastened so that when the child lies on them he is forced into the position of lordosis. The two bars are placed just far enough apart to allow the spinous processes to project between

them. If this precaution is not observed excoration will occur over the spines where the pressure is made.

The child should be strapped firmly on to the stretcher under an apron front. In order that he may be raised and slightly suspended in an upright position from time to time padded loops are passed under the arms. If necessary or advisable the

FIG. 123.—The stretcher in use in a case of dorsal Pott's disease. This patient remained on the stretcher for over a year.

head may be held in the same form of headpiece which is used in the Sayre's suspensory apparatus and traction made on the upper part of the column. It is important that the child should be kept on the stretcher as quietly as possible, and that his shirt or other garments which require changing be left on as long as is consistent with the health and comfort of the patient.

The bed which was invented by Dr. Gorham, of Albany, is applicable in the treatment of such cases.

Ordinarily, if the disease occurs in the upper dorsal region, the same variety of jurymast should be used as in the cervical; and because it is impossible to get purchase enough with the use of the jacket or brace alone, something must be used which will carry suspension further up and lift the weight of the

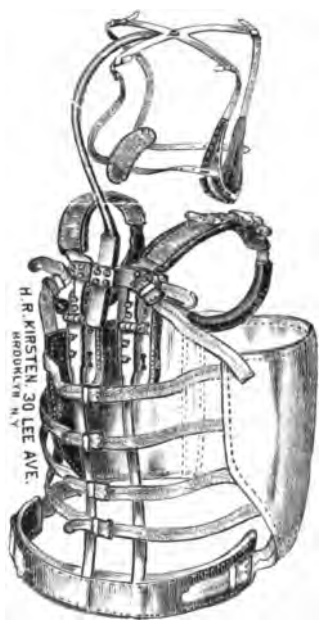


FIG. 124.—The author's improved arrangement of Taylor's brace jurymast with four-armed steel cross-pieces for making traction directly upward on occiput and chin, and steel spring to separate face straps.

head from the inflamed part. Where the disease occurs in the lower dorsal or upper lumbar region the same form of jacket or brace can be applied with the jurymast; it is in this portion of the spine that the disease is treated with the least difficulty, because it is easy to gain sufficient pressure by means of the apparatus to avoid an increase of the deformity.

Where the disease occurs lower down in the lumbar region

the difficulty of lack of support is again encountered, and the jacket, or brace, must be supplemented by the addition of a long piece extending down posteriorly as far as the coccyx, in order to give a base of support to the diseased portion.

When the patient comes for treatment the operator should note the exact amount of deformity which is present. This may be done by means of a lead tape, which is pressed carefully along the spine, from the occipital protuberance to the coccyx, while the patient is lying on a flat surface face downward. After pressing the tape accurately along the spine so that it is perfectly adapted to every depression or protuberance, it is then removed and laid upon a piece of stiff paper; the impression is traced with a pencil on the paper, and this can be cut out and

FIG. 125.—Author's spring for spreading face straps.

applied to the spine for correction. Another way is to take a stiff piece of paper, or cardboard, cut the shape so that it will fit approximately to the spine, lay it on the back and by means of a compass or a pencil, mark the exact shape of the spine along the edge of the paper. This is cut out and tried on to see if it is correct. From this diagram of the deformity and others made during the course of the treatment, the surgeon may be able to keep an accurate record of the increase or decrease of the deformity, so that in case the child improves and the deformity decreases, the progress may be noted down from time to time. Also this same diagram of the spine may be used in fitting the brace correctly to the spinal column so that the pressure may be obtained at the right place. There

are various forms of apparatus which are used by which the patient walks about on a sort of wheel-crutch, Fig. 126, but these are exceedingly cumbersome, and I think of less practical use than the forms of apparatus already mentioned. One of the difficulties always encountered in every form of apparatus is the excoriation of the skin; this will be especially likely to occur in summer when the perspiration softens the

126.—Wheel crutch.

skin and the pressure is kept up continuously. Constant care must be taken to prevent this distressing symptom; frequent changing, frequent washing of the skin with astringent solutions, and the application of soothing powders, like talcum powder, must be kept up. One of the most efficient astringent lotions is made by taking a small quantity of powdered tannin and pouring boiling water on it; this is allowed to stand for a little while, and then the solution is applied frequently to

the sore spot; of course, the pressure should be shifted as much as possible from the spot which is excoriated, and the air allowed to come in contact with it until it is healed.

Where there are symptoms of paralysis there is a question as to how much should be done. The author's experience with a number of cases is that the retentive apparatus should be applied and the patient kept in bed, and it is believed that the most of these patients recover if sufficient time and proper treatment be given. With the relief to irritation and the removal of the inflammation the thickening of the peri-meningeal tissues decreases, the pressure is relieved, and, as a result, function of the parts slowly returns. I have seen in patients, who have been for eighteen months with no use whatever of the lower limbs and no sensation, the function returning with surprising rapidity at the end of that time. Within the last few years the operation of laminectomy has been proposed and attempted, and it is still a debatable question whether it is well to perform an operation for relief of the pressure on the cord. The operation has been much discussed in the surgical societies, but as the pressure is the result of a pachymeningitis, and as the results of the operation thus far obtained have not been flattering, it can hardly be advocated as a cure for this form of paralysis. And still further, as most of these cases tend to get well under treatment, and function of the limbs may be restored without operation, it seems impracticable to perform such an operation unless imperatively called for. Where there is danger of a permanent paralysis, as shown by the fact that paralysis has existed for perhaps two or three years with no improvement, then it might be considered; but where the paralysis has existed for only a comparatively short time, and there is probability of the inflammatory deposit being absorbed it is better to wait for a considerable time before attempting so severe an operation.

The apparatus, whatever it may be, should be worn until all traces of disease have disappeared, and even for a time after as a precautionary measure. No certain time for recovery can be given, but it is never well to state in the beginning that it will take less than eighteen months or two years.

The operations of Chipault and Calot for forcible correction of the deformity have not shown such flattering results that I feel justified in recommending them.

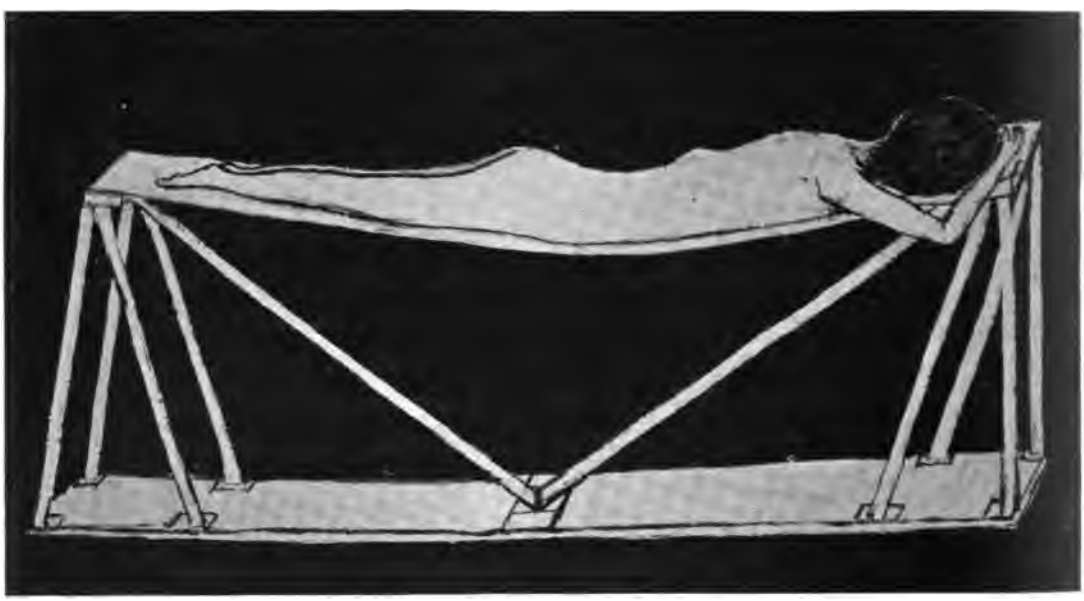


FIG. 127.—Dr. Blaisdel's apparatus for application of plaster of Paris jacket with the patient in the horizontal position. The patient lies on a narrow sheet of muslin which is incorporated in the jacket.

Sometimes it may be necessary to apply the jacket with the patient lying down. This may be done by placing him on a narrow sheet of muslin, as shown in the cut, and wrapping the plaster bandages around muslin, shirt and all, and then cutting the incorporated portion of the muslin away from the rest after the cast has hardened.

LATERAL CURVATURE OF THE SPINE OR SCOLIOSIS.

Lateral curvature of the spine is a condition in which there is a permanent lateral deviation from its normal shape, without actual disease of the vertebræ or intervertebral cartilages. I believe that the opinion that every person has naturally some lateral curvature is erroneous, and it has not been borne out in the examination of a large number of cases. Normally, every one should be symmetrically built. The shoulders should be on a level, the hips of equal size, and the limbs of equal length. Any deviation from this condition is abnormal, and constitutes, in greater or less degree, a deformity.

VARIETIES.—There are two varieties of lateral curvature: in one the curve is flexible, and the spine may be straightened at the will of the patient, or with some help from the attendant or surgeon, and will remain straight so long as the superincumbent weight is lifted from the column, or so long as the muscles of the two sides are able to retain an equal degree of tonicity. In this variety there are no contractured muscles in the early stage; the condition consists simply in diminished strength or tone of the muscles on one side, with a normal contraction of muscles on the opposite side; as a result the weak muscles give way, and the opposite muscles, acting with their usual force, have a tendency to draw the spinal column in their direction. This variety of lateral curvature may be easily corrected if prompt and careful attention be given to the conditions which lead to its existence, and the prognosis in such a case, especially if coming on after the age of thirteen or fourteen years, may be considered good, though much patience and persever-

ance in the treatment and careful attention to the case are absolutely necessary. The other and more serious variety is the form known as rotary lateral curvature. In this variety, while there is no actual disease in the spinal column, there is a vicious contracture of certain muscles of the spine. I believe that Shaffer's explanation of this variety is better than any other, and that is that there exists structural shortening or contracture of some of the small inner muscles running from one vertebra to another along the spine. When this structural change has taken place the muscle is finally developed into a fibrous cord and loses its elastic properties. The muscles remain in this condition permanently. It is an unsettled question whether a flexible curve, which is simply the result of weak muscles, will result in a fixed curve with rotation; but there is no doubt that many cases which originally are flexible, and which might be easily treated in the early stages, end in permanent deformity. There are cases which have the tendency to take on structural change from the first, and it is very doubtful whether this tendency to contracture can be prevented. In the one case there is the condition which can be remedied and the patient restored to symmetry, while in the other there is a condition which is from the first vicious in its tendency, and which tends toward ultimate and unchangeable deformity.

ETIOLOGY.—Lateral curvature may be either congenital or acquired, but the former variety is very rare. It is from five to eight times more frequent in girls than in boys, and most frequently appears at about the age of puberty, although it sometimes occurs in very young children and occasionally in middle life. In the ordinary cases of flexible curve the patients are usually young girls who are not strong, and who seem to lack vitality. They have poor appetites, are pale, frequently menstruate profusely, and show a general lack of systemic tone.

As a rule, they are not inclined to take much exercise, or, if they do, it is only at irregular intervals; they become easily tired and suffer from headaches and are often astigmatic, flat-footed or knock-kneed. In these cases the constitutional condition is largely at fault, and by remedying this low tone of the system and correcting certain tendencies, which these patients have, to bad habits of sitting, standing, walking, etc., recovery is possible. The fact that curvature occurs more frequently in girls is probably because boys by being more out of doors and

FIG. 128.—Ordinary case of lateral curvature.

enjoying more active sports and keeping up a better general condition are rendered stronger and more likely to resist the tendency to any form of deviation of the spinal column.

The other and more serious variety may occur at an early age, and the earlier it begins the more grave the prognosis. Where it exists in very young children it is frequently the result of rachitis, and these cases are exceedingly difficult to treat, especially as the treatment must be prolonged over a period of years. The deformity, which is apparent in lateral

curvature of the spine, consists in a lateral deviation of the line of the spinous processes from the perpendicular. The curve is always named from the direction of its convexity. If the convexity is toward the left it will be known as a left curve, and if toward the right, a right curve. There may be one curve or there may be two, or perhaps more. Usually there are two curves, one of which is known as the primary and the other as the secondary, or compensatory curve. The secondary curve is the result of an unsuccessful attempt to straighten the original or primary curve, for if there is only one curve the patient is likely to be ill-balanced, and there is an attempt on the part of nature to restore the equilibrium. There are a number of conditions which may act as exciting causes of what is known as the static form of lateral curvature, and among these are certain conditions of the lower limbs, as one-sided flat foot, where the arch of one foot is lower than the other, with the result that the leg on that side is practically shortened. Normally the plane of the pelvis from one iliac crest to the other should be level, but if one leg is shortened the result will be that the pelvis on that side will drop down. This dropping varies from one-half inch to even more. A condition of knock-knee, where one leg is bent more than the other, may also be cited as a cause of static curve, and as this condition very frequently accompanies that of flat foot, the leg on one side becomes practically very much shorter than the other. Unevenly bowed legs may act in the same way.

If one side of the pelvis falls to a lower level than the other the result would be that the spinal column, which is fixed at a right angle to the plane of the pelvis would assume an oblique direction if inflexible, the weight of the patient above the pelvis would cause him to lose his equilibrium, and he would be unable to retain the upright position. However, in order to do this the

spine is curved toward the opposite side, so that the head is brought again over the middle line of the pelvis, and the balance is maintained. These points should always be carefully borne in mind in making an examination of the patient, although a large proportion of cases are not a result of this condition. Not only the spine, but the entire length of the trunk, limbs and feet should be examined; if these are neglected, and the spine alone attended to, it is impossible to remedy the curvature.

Fig. 129 represents the production of lateral curvature from one practically shortened lower extremity.

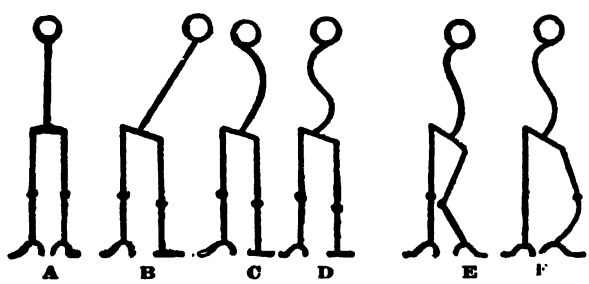


FIG. 129.

A. Both limbs of the same length; the pelvic plane is level and the spine maintains its perpendicularity.

B. One limb practically shorter from dropping of arch of one foot; pelvic plane tilted and spinal axis deflected to one side. (Of course, such a condition is actually impossible, but would be possible if the spine was rigid instead of a flexible column, although it would be impossible for the patient to maintain her upright position.)

C. Same with attempt of spinal column to right itself in order to bring head over center of gravity and preserve the equilibrium.

D. Same after production of the secondary curve.

a b c

FIG. 130.—Case of lateral curvature.

a. Habitual position.
b. Position which the patient is able to maintain for a short time when so placed.
c. Position which the patient is able to assume voluntarily. (Key position.)

E. Similar result from one practically shortened limb from knock-knee; arches of feet normal.

F. Similar result from one practically shortened limb from curvature of bones of left (bow-leg); arches of feet normal.

A static curvature may be produced by any cause actually shortening one leg if the shortening is not compensated for by raising the foot on the affected side so that the pelvic plane is restored to the level. Such actual shortening may result from non-development of the limb from paralysis or ankylosis of the hip joint, or from loss of bony substance from disease or operation. It is usually stated in works on orthopedic surgery that lateral curvature is the result of bad positions habitually used in sitting or standing. This is true to a certain extent, but the author's belief is that these bad positions are the exciting rather than the primary causes. It would be difficult to find a person who stands up squarely on both feet habitually or who sits up straight on all occasions. The days of the old straight-backed chair and the backboard have gone, and if positions of relaxation and ease were the primary cause of curvature there are few persons who would be straight.

In all cases of lateral curvature there is a predisposing cause in the unequal balance of muscular power on the two sides of the spine. The truth of this theory is demonstrated by the results of the treatment, which consists mainly of strengthening the muscles of the weak side. Nevertheless, the elimination of one cause is as important as the other, and not only must the weak muscles be strengthened but the bad habits of lounging while sitting or standing must be corrected.

To quote from Bradford & Lovett,* Sigfried Levy thinks there are two distinct factors in the production of habitual scoliosis; one, "an anomaly of nutrition," a purely organic

*Orthopedic Surgery, p. 133.

matter; secondly, certain mechanical causes—faulty positions of standing and sitting. Neither one of these factors can cause it alone; both must be present at the same time.

Certain occupations where one arm is used in excess may act as exciting causes; in children bad positions while studying, writing or at piano or violin practice act as exciting causes.

Among the pathological conditions are: "Results of certain

FIG. 131.—Spinal column with rotary lateral curve.—Museum of New York Homœopathic Medical College and Hospital.

inflammatory conditions," as stated by Young;* such as torticollis, cicatrices from burns, phlegmons; caries or necrosis of the ribs, etc.; pleuritic effusions especially empyema; certain muscular conditions, as spasms, unilateral muscular atrophy and hypertrophy; muscular rheumatism (myositis), sciatica and other nerve conditions; neurotic changes, either akinetic or

*Orthopedic Surgery, pp. 174-175.

hyperkinetic, especially the former, of which antero-, poliomyelitis is the commonest example; morbid growths of the sides of the pelvis or trunk, as encephaloid or sarcoma, by their enormous weight; and sacro-iliac disease from the habitual faulty position assumed to relieve suffering. He also states that trauma is more apt to produce antero-posterior curvature than lateral, while non-reduced lateral dislocation and gunshot wounds might produce lateral deformity. It may follow certain diseases, as typhoid, cerebro-spinal meningitis, etc.

The actual pathological conditions which exist in an advanced case of lateral curvature may consist of a change in the shape of the vertebræ themselves; also a similar change occurs in the intervertebral cartilage. Normally the two edges of the vertebræ should be of equal thickness, but if the spine deviates from its normal position so that there is a considerable curve the pressure is increased on the side of the concavity, while it is decreased on the side of the convexity, absorption taking place. The vertebræ and the intervertebral cartilage become wedge-shaped, the thin edge of the wedge being toward the concavity and the base toward the convexity. This will increase as the disease progresses, until finally there is such a change in the column and the vertebræ that it is beyond remedy. Another change which takes place is the peculiar rotation of the vertebræ in severe cases. Rotation consists of a twisting of the column in such a manner that the bodies of the vertebræ swing round and away from the median line toward the convexity of the curves, while the spinous processes remain nearer the median line. When rotation has taken place the line of the spinous processes is much straighter than that of the bodies of the vertebræ, so that when a patient with rotation is examined the amount of curvature which is visible is the least that actually exists. This fact should be borne in mind in

estimating the actual amount of deformity. As the rotation progresses certain of the abnormal conditions present themselves as a consequence. The ribs being closely attached to the vertebræ must move more or less with them, and, as a consequence, the shape of the chest becomes changed. When viewed from behind it will be found that the ribs are more prominent on the side of the convexity and depressed on the side of the concavity. When viewed anteriorly the chest is flatter and the mammary gland smaller on the side of the convexity, while they are more prominent on the side of the concavity. Also when the ribs project backward on the side of the convexity they carry with them the scapula, the lower angle of which becomes much more prominent on that side than on the other. In bad cases the ribs on the side of the concavity are crowded together, while on the convex side they may become widely separated and even be pushed down inside the iliac crest. The most widely accepted theory of the cause of rotation is that of Judson, which is that to the bony processes of the spine are attached the muscles which control the movements of the spine, while the bodies of the vertebræ have few muscular attachments. The bodies of the vertebræ form the supporting portion of the column, while the processes give no vertical support. Thus while the bodies hold up the superincumbent weight, they have not the lateral support to keep them in their proper position that the spinous processes have, with no weight to sustain. When there is a tendency to lateral curvature the column bends at its weakest portion, and the bodies swing out of the perpendicular, while the spinous processes are held more nearly in their proper position by the muscles which are attached to them.

This theory of the causation of rotation when slight lateral curvature already exists is very plausible, but it does not ex-

plain why rotation should in some cases precede any appreciable lateral curve. That such a state of affairs does occasionally exist I have been abundantly able to demonstrate by the changes in the shape of the chest and the prominence of one scapula, while the line of the spinous processes was perfectly straight. This leads me to believe that, in some cases, the curvature is secondary to rotation, the result of some vicious contraction on the part of certain muscles and ligaments.

SYMPTOMS.—The symptoms may vary from a slight deformity attended with no pain, to great deformity, both lateral and rotatory, and great pain, resulting from the contractures and pressures upon various organs.

Frequently the early symptoms are not at all marked. They may consist in a slight deviation of the column to one side. The first discovery is usually made by the dressmaker, who finds difficulty in fitting a dress on account of the back seam running to one side and requiring a change of plan to bring it straight. Sometimes it will be noticed that there is a difference in the height of the shoulders or hips. One shoulder becomes much higher than the other, and, if the principal curvature is in the dorsal region, the shoulder on that side is the one which is higher. The shoulder on the side of the concavity is lower and the hip on that side is more prominent. That side of the body is also very much hollowed, while the opposite side may be straight, or even convex. The deformity may increase until the spine is practically shortened, taking on almost the shape of the letter "S," so that the distance between the head and pelvis is very much diminished. On account of the change in the shape of the pelvis the vital organs may be pressed upon, tbere may be severe pain, which is referable to the heart, lungs, or, perhaps, to the liver or other organs, and the patient may suffer from any variety or number of symptoms caused by

pressure from the change in the shape of the chest. The cases of lateral curvature which come most frequently under the observation of the surgeon occur in young girls, and, as before stated, are very likely to be discovered by the dressmaker in attempting to fit a garment to the child. Then a deviation is discovered in the height of the shoulders or of the hips, or, perhaps, one shoulder blade is found more prominent than the other.

Frequently, through the mistaken notion that it is simply a condition of growth or unequal development, the child is allowed to go on without treatment until the deformity becomes so apparent that the parents become alarmed and seek advice of specialists. There is no opinion which is so erroneous, or which leads to greater disappointment, as the one that these curvatures will take care of themselves, and that as the child grows older the spine will become straight. Where spinal curvature exists the tendency is always towards progress rather than decrease of the deformity, and the earlier the case can be taken in hand the better the result will be. It is true that, in some cases, there is a spontaneous arrest of the disease, but no one can decide which way a case will terminate. When a child is examined it should be in the most careful manner and from head to foot. The arches of the feet should be carefully inspected to see if there is flattening; the limbs and knees should be examined to see if there is a tendency to in-knee or to bow-legs, and everything which can possibly enter in as a causative factor should be carefully attended to. During the examination the child should be made to stand with its back to a strong light, so that shadows will fall equally on both sides; careful notice should be taken of the position which the child assumes in standing, of the line of the spinous processes and of any deviation of the body from the normal. It is well to take pen

and ink and carefully dot the point of each spinous process; in this way it is easy to determine whether there is a slight deviation from the perpendicular or not. Sometimes, in mild cases, this is quite difficult. Various instruments have been invented to show the amount of deviation, but a string fastened to the skin on a bit of plaster over the first cervical vertebra and allowed to hang down with a small weight on the end is sufficient to indicate the change from a straight line.

If there is no deviation from the perpendicular the next thing should be to ascertain whether the curve is a flexible or fixed one. If the child is made to stand with her knees stiff, to bend over forward and try to touch the floor with the tips of her fingers, the weight of the upper portion of the body then is suspended, as it were, from the pelvis, instead of resting upon it. The result will be in the case of a flexible curve, that the spine straightens out of itself, and all the abnormal conditions which were present while the patient was in an upright position disappear. If, on the other hand, it is a fixed curve, with contracture of the muscles on the side of the concavity, the curve may be lessened, but will not entirely disappear, nor does the projection backward of the ribs of the scapula disappear. Another test is by the use of Sayre's suspensory apparatus. If the child is placed in this apparatus and drawn up so that the weight hangs from the shoulders and head, allowing the weight of the body and limbs to act as a counter-extension, in case of a flexible curve the deformity disappears entirely; in case of a fixed curve the deformity may materially diminish, but does not entirely disappear. All these points must be carefully taken into consideration in making the prognosis; or where the case is one of flexible curve the prognosis may be considered favorable, as a rule, but where the deformity does not disappear great caution must be observed in predicting a favorable termi-

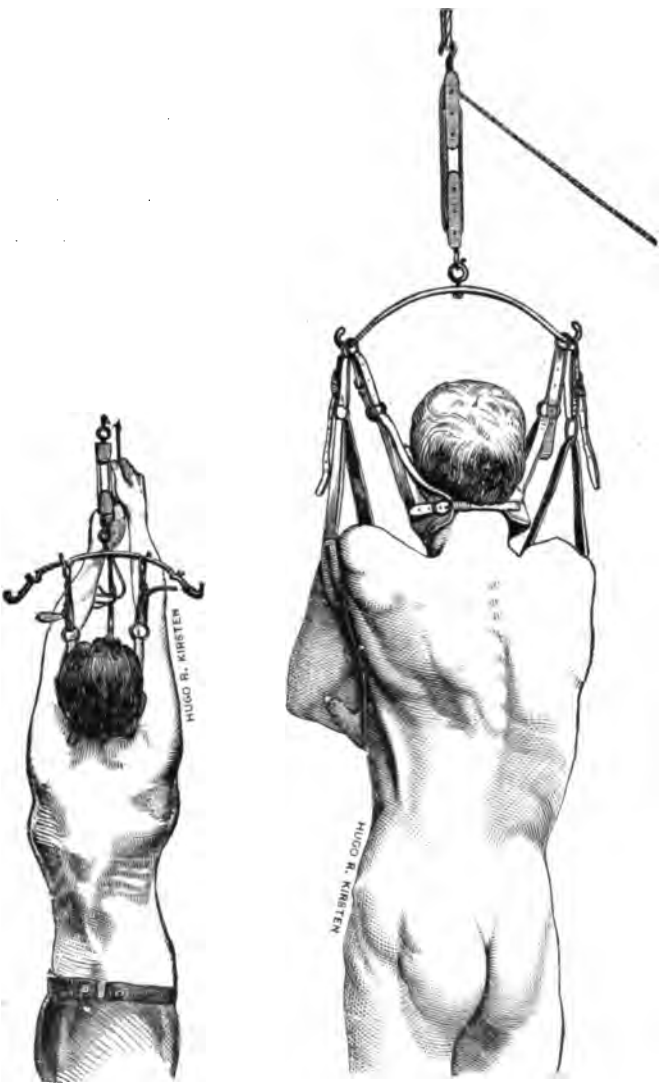
nation. It must be borne in mind in making the prognosis of a condition of this sort that without treatment the tendency of the disease is always to get worse; but in case the general nutrition can be improved and the curve is flexible, and proper methods be instituted, a complete cure may be expected.

TREATMENT.—When a patient with lateral curvature is brought to the surgeon, the parents or guardian should be impressed with the fact that it is absolutely necessary that the

FIG. 132.—Flexible curvature.

treatment should be persistent, and that it may take a considerable period of time. If for any reason, from negligence or carelessness or laziness on the part of the parent or guardian, the treatment is omitted or not systematically carried out they may as well understand at once that there is no use in attempting to do anything. One fact peculiar to this variety of deformity is that as it occurs in children who are not strong, and

as it is the result of lack of strength, the very exercise and methods which are used to correct the deformity are likely to



FIGS. 133-134.—Showing effect of suspension on cases of fixed curve

become exceedingly tiresome and distasteful to the patient, because they require a certain amount of muscular effort, and it

becomes necessary to use a good deal of will power to overcome this distaste for physical exercise. On the other hand, if they have the opportunity, these patients will frequently spend hours in dancing or other amusements under the stimulus of excitement, music, etc., while exercise morning and night with no apparent immediate object in view is almost invariably shirked; indeed, unless careful watch by the parent or guardian is instituted, and all the force of a strong supervising mind is exerted, the treatment will soon be discontinued, resulting in disappointment to patient and surgeon. There is probably no class of abnormal conditions which come under the charge of the specialist in any disease which requires so great an amount of perseverance as the variety under consideration.

If it is found on examination that the child has any deformity of the limbs or feet these should be remedied first of all; the depressed arch of the foot should be raised and the anterior tibial muscles strengthened; if there is knock-knee it should be attended to and the legs straightened, if possible, or; if that is not practicable, the foot should be sufficiently raised so that the plane of the pelvis is made level. From the first, careful attention should be paid to diet, to nutrition, to remedies, sleep, and to the general habits of the patient. If she has been allowed to eat irregularly and of improper things this should be at once stopped; if she has been allowed to sit in bad positions and stand in slouching or drooping attitudes she should be corrected. It is always well to inquire into the way in which a child sits at her studies, at the piano, or reading. Almost all the patients afflicted with spinal curvature are those who are exceedingly fond of sitting curled up in luxurious chairs; if they sit at the piano or desk they are likely to sit with the shoulders drooping and bent over, and always in a more or less reclining position. One fact should be borne in mind in

this connection, and that is that many of these children have, perhaps, an undiscovered astigmatism; they may be myopic and in order to get a better view of their music or of their books they bend over them, the condition of the eyes thus tend-

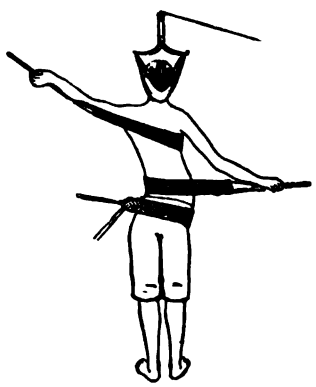


FIG. 135.—For correction of flexible curve.

FIG. 136.—For correction of flexible curve.

ing to increase the abnormal condition of the spine. Another thing, frequently children who are thus affected are those of very sensitive organization, in whom the artistic tendencies are highly developed. Such children are frequently passionately

fond of music; some are exceedingly fond of drawing, painting, etc., and their vitality is apt to be used up in the pursuit of their pleasure, which they gain from close application to musical or other artistic studies. Sometimes it is absolutely necessary that these studies be given up for a time, just as it frequently happens that those children who are unusually brilliant mentally and exceedingly precocious in school work may require to be entirely removed from school, to allow their minds, as far as possible, to lie fallow for a time. All of these points are exceedingly necessary to the successful carrying out

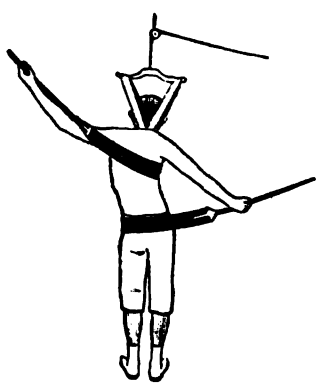


FIG. 137.—For correction of flexible curve.

of the treatment of a case. The meals of a patient should be regulated, plain, wholesome diet prescribed, with plenty of fruit, vegetables, meats, and, following rather in the line of Frothergill, I am inclined to believe that butter and oil are very excellent articles of food. In cases of flexible curve it may be unnecessary to use any form of apparatus. Carefully instituted exercise may be entirely sufficient to remedy the curvature, and the use of galvanism, or even faradism, or better still, the sinusoidal current to the back, is also an excellent adjuvant. Of course, all of these agents must be skilfully and carefully applied. The exercises should be such as have a ten-

dency by their action to rectify the curve, and careful study should be made of each individual case, to see what the effect of each motion is upon the patient. The following system, prescribed by Bernard Roth, is excellent and may be modified to suit each case:

"First. Lying on back; arms by the sides of the body; palms upward; slow, deep inspiration by the nose; slow expiration by the mouth. Repeated four times.

"Second. Similar exercise with the arms extended upward by the sides of the head. Repeated four times.

"Third. Same position as first; head-rotation on axis to right and left alternately; also lateral flexion of head to right and left alternately. Repeated four times.

"Fourth. Lying on back; simultaneous circumduction of both shoulder joints from before backward; elbows and wrists kept extended. Repeated twelve times.

"Fifth. Lying on back; one hip circumduction both ways; knee kept extended. Repeated ten times.

"Sixth. Lying on back; simultaneous extension of arms upward, outward and downward, from a position with the elbows flexed and close to the trunk. Repeated four times.

"Seventh. Lying forward; one hip circumduction both ways; knee kept extended. Repeated ten times.

"Eighth. Sitting on couch with back at an angle of forty-five degrees; ankle circumduction down, in, up and out, while the toes are directed inward the whole time. Repeated twenty times. Also, foot adduction, patient resisting; abduction, surgeon resisting. Repeated eight times. For flat-foot.

"Ninth. Lying on back, with arms extended upward by the sides of the head; flexion of both arms, surgeon resisting by grasping the hands, followed by extension, patient resisting. Repeated six to eight times. (The patient's knees, flexed over the end of the table, fix his trunk.)

"Tenth. Patient astride a narrow table or chair without back, with arms down and hands supinated; trunk flexion at lumbar vertebræ, patient resisting slightly, followed by trunk extension, surgeon resisting by his hand against back of patient's head. Repeated six to eight times.

"Eleventh. Patient, with arms extended upward, stands with head, back and heels against a vertical post with pegs on each side, which he grasps. The surgeon gently pulls the patient's pelvis forward by his hands on the sacrum, patient resisting, and then the patient moves back the pelvis to the post, surgeon resisting. At no time are the patient's heels to be raised from the floor. Also pelvis rotation on its axis to right and left alternately, surgeon resisting with his hands on each side of the pelvis. Repeated six to eight times.

"Twelfth. Lying on back, with head and neck projecting beyond the end of the table; arms by the side of the body, palms up; the head is gently flexed by the surgeon's hand on the occiput, patient resisting, followed by head extension, surgeon resisting. Repeated eight times.

"SUBSEQUENT HOME TREATMENT.—To keep up the improvement and to prevent any relapse in a cured case it is important to continue to enlist the patient's co-operation and interest in his or her own case on ceasing treatment; and for the last ten years the author has been in the habit of giving patients on leaving a written home prescription of movements, of which the following is an average example:

"*Final Home Prescription of Exercise:*

"One. Lying on back; arms by sides; palms upward; slow, full inspiration by the nose; slow expiration by the mouth, four times.

"Two. Sitting astride a chair, with the arms directed upward by the sides of the head and holding a stick, or as in one;

trunk lumbar flexion and extension; also trunk rotation on its axis right and left, six times.

"Three. Same position as one; head rotation on axis to right and left; also head lateral flexion and left, four times.

"Four. Lying prone on the ground; heels fixed by pressure on them; arms as in two; trunk-raising (extension) and flexion; also front rotation on its axis and left, six times.

"Five. Same position as one; one hip circumduction both ways; knee kept extended, ten times (a shot weight of five to ten pounds is attached to the foot to increase the severity of the exercise).

"Six. Lying on back; slow simultaneous circumduction of both shoulder-joints from before backward; elbows and wrists extended twelve times.

"Seven. Lying prone on group; heels fixed by pressure; trunk kept raised from ground (extended); simultaneous extension of the arms upward, outward and downward from a position of elbows flexed and close to the trunk, four times.

"Eight. Standing with back against door, arms directed upward, and hands grasping two pegs fixed into the door; pelvis rotation on vertical axis right and left, ten times; also the hanging with the feet raised off the ground and the sacrum kept touching the door, four times.

"Nine. Lying prone; one hip circumduction both ways; knee kept extended (a bag of shot, weight of five to ten pounds, is attached to the foot to increase the severity of the exercise).

"Ten. Walking forward and backward with arms directed upward by the sides of the head and holding a stick, or arms by sides; palms directed forward, a hundred steps.

"This 'home prescription' is practiced for half an hour twice a day for six months, and then once a day for another six months."

FIG. 138.—The author's case of weak muscles of the back following mild attack of fever (typhoid spine). Radiagraph showing organized exudate about the last dorsal and first lumbar vertebræ. (Photo, by G. E. Pfahler, M. D., Philadelphia.)

In many of these exercises after filling the lungs the singing of the syllable "ah" during exhalation helps to develop the chest, while full breathing assists in forcing the ribs into correct position. Some of my patients have been very much benefited by daily instruction and exercise in the Delsarte sys-

FIG. 139.—Showing double bar for extension exercise.

tem. The use of light dumb-bells, not weighing over one-half or one and one-half pounds, or of light Indian clubs, is also an excellent method of treatment, bearing in mind, however, that only such movements should be employed as have a tendency constantly to bring the spine in the correct position. The use of the double bar is good, the patient taking hold of the upper

bar with the hand on the side of the lower shoulder and drawing herself up as shown in Figure 139.

The bathing of the back and limbs at night with salt water and massage to the muscles of the back are also great helps. The Swedish movement given by a competent operator is probably the best method of applying massage, or mechanical massage by use of a vibratory apparatus may be employed.

The braces usually sold by the instrument makers, and which

FIG. 140.

FIG. 141.

Showing methods of exercise by weights and extension.

are built on an erroneous principle, are of absolutely no use: in fact, they are rather worse than useless, because they are mechanically incorrect, have no good effect whatever upon the curvature, and by their weight and impeding motion are detrimental in their effect rather than curative. In many forms of apparatus the tendency to tilt to one side from the drooping over of the spinal column is lost sight of, and while, when at first applied, the patient may for a short time, maintain an upright position, after a little the sagging or the loss of strength causes the apparatus to slip up onto the large hip, and the result

is that the body is pushed over one side and maintained in an incorrect position by the very apparatus which was supposed to correct it. Many of the braces mentioned are supposed to act by means of crutches under the arms which push up the shoulders; but it must be remembered, as pointed out by Sayre, that the shoulder is very movable independent of the spine,

FIG. 142.—Self-suspension exercise.

which is not affected to any degree by pushing up the shoulder. On the other hand, when the spine is straightened the shoulders become level of themselves.

Occasionally light corsets may be of service, and a well fitting corset made with a solid bar in the back instead of the lacing, which fits very snugly, and which has more than the

usual number of steels, may be useful; to this may be added a Y shaped brace with straps going over the shoulders, having a tendency to bring the shoulders back to the correct position.

There are a large variety of shoulder braces which may have a good effect in mild cases, but it must be remembered that the action of a brace should be limited to that class of cases where the physical strength is insufficient to sustain the body in the correct position; they must simply act as aids or reminders in treatment, the treatment not to consist entirely in the use of the brace.

The following anecdote by Bernard Roth* is full of suggestions which the author has acted upon with good results:

"An eminent surgeon was consulted by a gentleman who became one of our first tragedians as to the best mode of correcting a stoop which he had acquired. The surgeon told him that neither stays nor straps would do him any essential good, and that the only method of succeeding was to recollect to keep his shoulders braced back by a voluntary effort. But the tragedian replied that this he could not do, as his mind was otherwise occupied. The surgeon then told him that he could give him no further assistance. Shortly after this conversation the actor ordered his tailor to make a coat of the finest kerseymere so as to fit him very tightly when his shoulders were thrown back. Whenever his shoulders fell forward he was reminded by a pinch under the arms that his coat cost him six guineas, and that it was made of very fragile material; being thus forced, for the sake of his fine coat, to keep his shoulders back, he soon cured himself of the stoop. He then showed himself again to the surgeon, who ever afterward, when consulted as to whether young ladies should wear shoulder-straps, permitted them on condition that they were made of fine muslin or valuable silk, for tearing which there would be a forfeit."

*Bernard Roth, Lateral Curvature of the Spine.

A patient who has a flexible curve should always have a comfortable chair made which should be arranged so that he can read, write and study without leaning forward or turning himself, a chair with a good solid back which leans back slightly, with broad arms which are sufficiently high that when the elbows are placed upon the arms the shoulders are slightly raised; the arms should be slightly padded; the back

FIG. 143.—Volkman's inclining seat.

and seat may or may not be padded, according to the wish of the patient.

This chair should be low enough to allow the patient to sit with the feet resting comfortably on the floor or a footstool, and should have a swinging desk so arranged that it can be changed to any position at will; and strong enough to support a book so that the patient can read without leaning forward. Sitting on the inclined seat of Volkman (Fig. 143) to reverse the curve is a good method of correction.

A good effect is often produced by horseback riding. Of course, it is necessary to observe the effect of the position in the saddle on the curvature, and to have the saddle so made as to reverse the curve. The patient not only gets the effect of the position on the curvature, but also the benefit of the stimu-

FIG. 143a.—Author's apparatus for correcting lateral curvature.

lation from the air and exercise on the general health. The patient should be taught to sleep on a hard mattress with a low pillow. She does not need to be uncomfortable, but the pillow should be sufficiently low that when the child lies on the back he is nearly in a straight line.

Riding a bicycle gives exhilarating and invigorating exercise, and is good in its general effect if not overdone.

In the treatment of cases with a fixed curve the condition is much more complicated and difficult; we have to overcome rigidity of the contracted muscles, as well as the simple abnormal position of the body, and in these cases exercises alone are of very little value. The first thing to be attempted is the stretching of the affected muscles, and for this purpose some form of apparatus must be employed which has sufficient power, and which can be applied in such a position that it has the effect of constantly putting these muscles on the stretch. Properly made and correctly adapted braces made especially for each case are useful, but as before stated, the ordinary stock braces sold by the instrument makers are of very little use. A very efficient agent is one of the forms of jacket which can be molded to the body. These are placed in position while the patient is suspended in Sayre's suspensory apparatus, so that the weight of the body and the limbs has a tendency to drag down and straighten out the spinal column simply by the weight. In Germany some surgeons in order to overcome an involuntary, or supposed involuntary, contraction of the muscles, have advocated chloroforming the patient in this position. This seems to be an exceedingly dangerous procedure, because it is well known that when chloroform is administered the patient should always be placed in position with his head as low if not lower than the body, and dangerous syncope or sudden death might be the result of the suspension of the patient under chloroform. It should always be remembered that the patient should never be allowed to use the suspension apparatus when alone, as cases of fatal results have occurred where the patient has become entangled in the apparatus, and, becoming unable to extricate himself, has expired before assistance could be

had. During the suspension of the patient the plaster of Paris jacket may be applied according to the method of Sayre, and this may be used as the apparatus for carrying on the treatment, except that, instead of keeping the jacket constantly applied as in cases of Pott's disease, it is slit up the front and arranged with lacings and eyelets, so that it can be removed each night. This allows the patient to be thoroughly cleansed, and is more healthful than if worn constantly. The objection to this form of jacket is that it has to be renewed frequently, it is heavy, is likely to crack, and is also affected by perspiration in hot weather. Another form of jacket can be

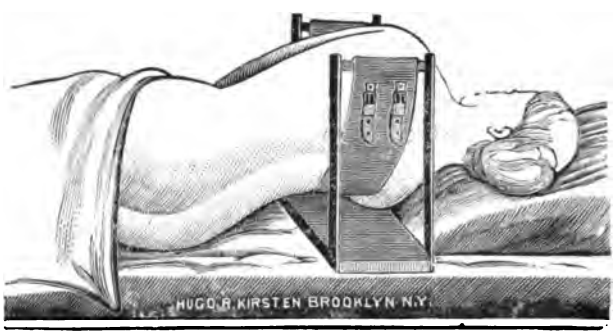


FIG. 144.—Canvas cradle for correcting curve while sleeping.

made of heavy felt which may be softened by the action of steam or of heat, and applied to the body of the patient while soft—as advised by Tivy*—but as the patient is apt to be burned by the application of the hot felt, I believe my own method is better. This is as follows: First a cast of the body should be taken in plaster of Paris while the patient is suspended, and from this a solid plaster mould is made on which to shape the felt. This method is better than any other, but instead of using felt, which becomes softened and out of shape in warm weather, sole leather is preferable, being much more

*Lateral Curvature of the Spine, by Wm. James Tivy, F. R. C. P.

resistant and easily made very hard and stiff. The jackets can also be made of rawhide, which is shaped on the cast while soft, and afterwards varnished. My preference is for the sole leather, because after the rawhide has been varnished its shape cannot be changed. After a plaster cast of the body is taken it retains all the deformity which remains while the patient is suspended, when it is wished to improve the shape of the body and to correct rather than retain the old deformity.

Therefore, I have adopted the method of changing the shape of the cast as frequently as can be borne, while with a

FIG. 145.—Author's leather jacket or felt jacket.

chisel or an ordinary carpenter's drawing knife the plaster is cut away on the side of the convexity and more added to the side of the concavity. It is also cut away from the enlarged hip and the prominent shoulder blade, and filled in on the opposite sides correspondingly. In this way the shape of the cast is gradually changed from one which contains all the original deformities to one which becomes as nearly as possible perfect in shape. The leather can be softened by soaking in cold water for a number of hours, and can then be nailed directly on to the cast while wet. It requires a little cutting and some piecing to fit it accurately over the prominences of the body, but after

it is dry it makes a very stiff and perfect corset. (Fig. 145.) It should never be so tight across the bust as to prevent the development of the breasts, and should always be padded with soft felt inside over the hips. Small holes should be punched through at intervals, or the holes of the nails with which it is fastened on the cast may give sufficient ventilation. When this is dry, if not sufficiently resistant, it may be varnished over with a thin solution of shellac, which adds greatly to its stiffness. This need not be put on so thick as to make it absolutely water-proof, but sufficiently to make the leather quite hard on the surface. From time to time, as frequently as the patient can bear it, the jacket may be soaked in water, and the shape changed according to the improved shape of the cast; in this way much improvement may be obtained in the condition of the patient. The only objection, of course, is that the wearing of the stiff jacket prevents the expansion of the lungs and is less likely to admit of rapid development of weakened muscles, though this is counter-balanced by the improvement obtained in the condition of the patient, and by the fact that the deformity is retarded if not cured. The jacket should always be removed at night and massage applied to the muscles.

In some cases it is almost impossible to prevent the advance of the disease no matter what means are attempted; it seems as though the vicious contraction of the muscles absolutely prevents any possibility of a cure; but still it is always best to try, and cases after three or four years have been so improved, although impossible to obtain an absolute cure, that by the art of the dressmaker the dresses are so arranged that no casual observer would detect that a curvature existed.

The use of the sinusoidal apparatus and vibratory massage is attended with benefit in treating the muscles on the weaker side of the spine.

HIP JOINT DISEASE.

Hip joint disease is a destructive tubercular inflammation involving the structures composing the hip joint. It most frequently originates in the head of the femur, but sometimes the acetabulum and occasionally the synovial membrane are the original sites of the disease.

The development is more rapid if the function of the limb is kept up and the irritation of the inflamed portion is continued.

FIG. 146.—Tuberculosis of head of femur. (Krause.)

As a result of the destructive process the head of the bone may be partly or completely removed, and in some cases only a spur of bone projecting laterally from the shaft remains of the neck, which has a bare and worm-eaten appearance. Changes may take place in the acetabulum also. On account of the strong traction of the muscles, the head of the femur is made to press strongly against the upper rim of the acetabulum. This gradually yields by absorption, while the

head of the femur slips up, leaving the lower portion. This is known as "migration of the acetabulum." In some cases the acetabulum becomes much deepened by new bony deposit in an attempt to cure by ankylosis, and this may be to such an extent that what remains of the head of the femur is found deeply enclosed in the bony tissue of the acetabulum. Sometimes both hips are affected simultaneously, or one may recover and the other become affected later on. The "migration of the acetab-

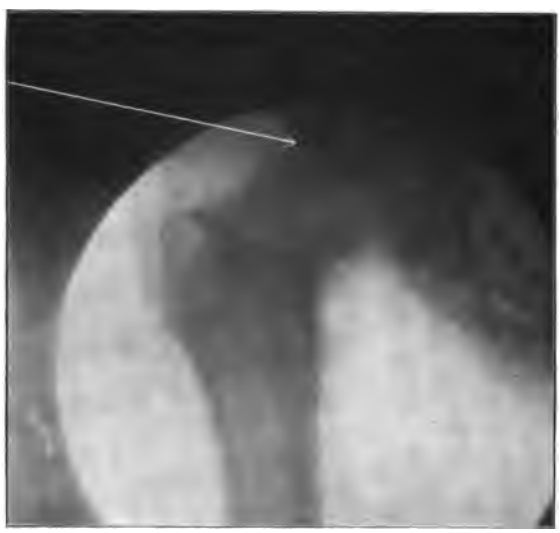


FIG. 146a.—Radiograph of tubercular disease of head of femur.

ulum" is accompanied by shortening of the limb, which may be drawn up so far as to bring the great trochanter above Nelaton's line. Sometimes the acetabulum is perforated, but usually a thick wall of newly formed fibrous tissue shuts off the abscess from the pelvic cavity. The acetabulum is usually filled with soft, velvety granulation-tissue. Cure takes place by absorption or calcification of the tuberculous tissue, or by discharge externally, with the result of throwing off the dis-

eased portion, and, later, the formation of bony tissue and ankylosis.

HISTORY AND SYMPTOMS.—When a child is affected with disease of the hip joint it may be traceable to some accident as an exciting cause, but not always, as children frequently meet with slight accidents of which they can give no account. But there is usually the predisposition to tubercular disease already mentioned. The accident may consist simply of a fall on the

FIG. 147.—Position assumed in standing with slight abduction of right leg. (Bradford and Lovett.)

hip, a sudden strain or wrench, or perhaps the exciting cause may be a severe cold. The child has a slight tendency to stiffness in the morning. The first thing noticed is a condition of malaise. There may be no complaint of any special pain, but if the child is carefully watched, a slight limp may be detected, and when the child stands it will be noticed that he rests on one foot, allowing the other limb to remain flexed, or slightly abducted, and he favors the affected side in whatever he is doing. These symptoms may grow less apparent or disappear later in

the day. If the parents are particularly observant these slight symptoms may lead them to consult a physician, and often at this early stage there are conditions which lead to a correct diagnosis. As the disease progresses the child may have pain at night, with the characteristic "nocturnal" or "osteitic cry."

The location of the pain varies, but it is generally referred to the knee-joint or the anterior and inner side of the thigh. Its cause is not clearly understood, but the intimate relation of the sciatic, obturator and anterior crural nerves seems best to explain the reflex pain. All these symptoms gradually increase in

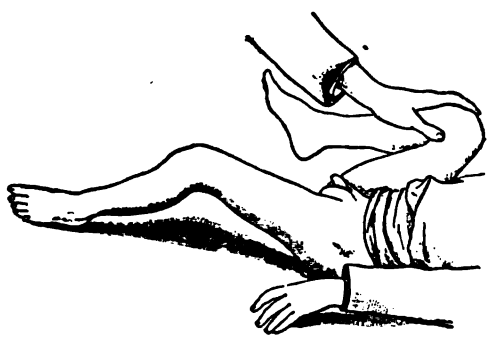


FIG. 148.—Estimation of disease by flexion. (Bradford and Lovet.)

severity, the limitation of motion is more marked, the child refuses to play and move about; or, if at all, it will be in some position in which he does not use the affected limb any more than he can possibly help. He tries to make extension by pressure on the affected foot with the well one. An apparent shortening of the limb becomes noticeable, which is due to the tilting of the pelvis upward on the affected side. The hip itself changes in shape, becoming broader, rounder and larger than that of the opposite side, and is accompanied by a shortening or loss of the gluteal fold. This goes on until the formation of an abscess. The presence of the abscess and its final opening and evacuation may affect the general health

to such a degree that the child dies of exhaustion or from amyloid disease of the kidneys, or secondary general tuberculosis.

Particular attention should be given to the motions of the hip joint in the early stages of the disease. Then the position of the foot may be normal as regards eversion or inversion, but this depends largely on whether the case has been treated or not. If the child has had no treatment there may be eversion in the early stage, but after the formation and discharge of abscess the foot is turned in and often rests on the other foot. The most severe pain is usually experienced during the so-called second stage, before the rupture of the capsule from the accumulation of fluid in the joint and increased tension, but after the rupture of the capsule the tension is lessened and the pain is less severe. As the disease progresses the limb becomes more and more fixed, and after the rupture of the capsule the limb is adducted and the foot may be rotated inward. Atrophy of the muscles of the thigh begins in the early stages; there may be rise of temperature before rupture of the abscess, but this is uncertain.

EXAMINATION.—Where a child has a history corresponding to the symptoms which have been detailed, a careful examination should be made of the entire body. He should be stripped and placed with his back to a strong light, and, standing on a level surface, it will be noticed that he supports his weight on one foot, and the leg of the affected side is slightly flexed, abducted and rotated outward; the gluteal fold is much shorter than on the other side, and the buttock flattened and broader. If the child is then placed on his back on a hard surface and an atttempt is made to press the leg down so that the popliteal space touches the table, the spine will become arched as the leg is pressed down, or if the thigh is flexed on the abdomen the

spine goes down flat onto the table. Attempts should be made to move the limb in every direction. The most distinctive sign characteristic of hip joint disease is the limitation of motion in all directions; neither flexion, extension, abduction, adduction or rotation can be carried to the fullest extent. The muscles about the joint are all affected by spastic contraction, and thus motion is limited. In some cases it may be necessary to diagnose between inflammation of the hip joint and inflammation of the lower lumbar vertebræ; both of these joints are acted upon by the ilio-psoas muscle, and any disease which affects either will affect the muscle, causing spastic contraction.

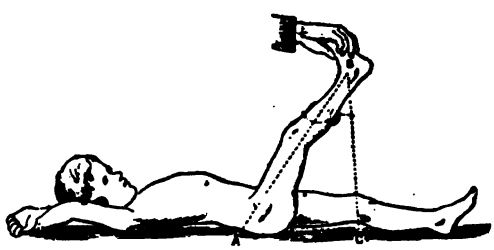


FIG. 149.—Estimation of flexion. (Bradford and Lovett.)

The result will be that the thigh is flexed upon the abdomen, and it is impossible to fully extend the limb. However, this being the only muscle which is affected by both disease of the spine and hip, when the spine is inflamed it limits the motion of the hip joint only in complete extension, outward rotation and abduction; the motions of rotation inward, adduction and flexion are unaffected; whereas in hip joint disease, where all the muscles about the joint are contracted, the limitation of motion is the same in all directions.

Also the flexibility of the spine may be ascertained by the method detailed in the chapter on Pott's disease.

Another important symptom is the atrophy of the muscles of the thigh. Comparative measurements of the two limbs will

always show a diminution in the size of the affected limb, and in the very early stages it often varies from one-half to three-quarters of an inch or more, and sometimes is so marked that it can be easily seen. Apparent shortening of the limb is easily

FIG. 150.—Position of the abducted limb when the pelvis is brought straight. (Bryant.)

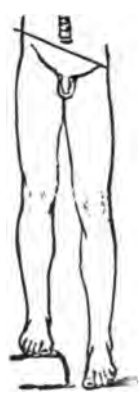


FIG. 151.—Position of patients when standing, with disease of the right hip joint and an abducted limb. The pelvis is tilted up on the affected side, and the limb thereby apparently shortened.

determined by comparative measurements from each anterior superior spinous process of the ilium to the malleoli of the corresponding limb. Tilting of the pelvis is determined by stretching one line between the two anterior superior iliac

spines, and another from the pubis to the umbilicus. In a normal case these lines should cross at right angles, but where the pelvis is tilted the angles are not right angles. In the latter stages, on examination, the symptoms are much more apparent, and the presence of abscesses, the greater limitation of motion, the shrinkage of the limb, the position of the leg with rotation inward and possibly actual shortening of the limb as demonstrated by measurements, all go to make up the diagnosis. It is believed that the most important symptom of all, however, is the spastic contraction of the muscles. An abscess ap-

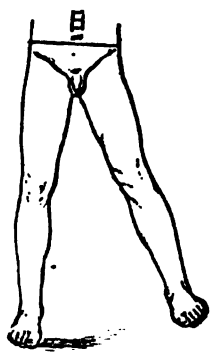


FIG. 152.—Abducted position of diseased left limb; pelvis brought into natural position at right angles to spine. (Bryant.)

parently coming from hip joint disease but without limitation of motion would not indicate disease of the joint. Occasionally abscesses from a diseased spine may burrow along the fasciæ and point at exactly the usual site of abscess resulting from hip joint disease. In such cases the symptom mainly to be relied upon and which is of the most value, is the presence or absence of limitation of motion, and the presence or absence of kyphosis. To determine whether there is actually shortening of the limb, or whether the displacement has taken place from the loss of the head of the femur, it is well to make an examination to determine the relation of the great trochanter

to Nelaton's line. If a line is drawn from the anterior superior spinous process of the ilium to the tuberosity of the ischium it will be found to pass directly over the upper portion

FIG. 153.—Apparent elongation of the right lower extremity in hip disease on the left side due to abduction of limb and necessary tilting upward of the pelvis on one sound side to allow of abducted limb being brought into line with the body. (Bryant.)

of the trochanter major if there is no displacement. If the head of the femur has been absorbed, so that there is displacement upward, the trochanter will be at some distance above the line.

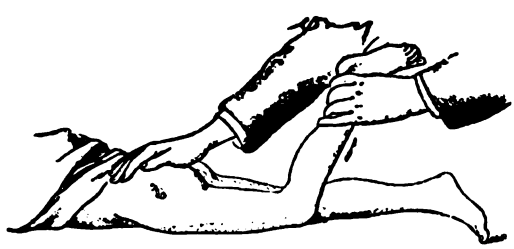


FIG. 154.—Examination for psoas contraction or limitation of extension in hip disease. (Hoffa.)

PROGNOSIS.—The prognosis in a case of hip joint disease is always more or less doubtful. The family history must be taken into consideration, the general condition of the child, the

stage at which treatment is begun and all the attendant circumstances. Many cases recover spontaneously with deformity which is permanent; other cases, in spite of the most careful treatment, go on to a fatal issue. As a rule, under treatment, if begun early, the prognosis may be considered generally

FIG. 155.—Hip joint disease, third stage, abscess presenting on outer aspect of thigh.

favorable to life. Many cases recover completely; some may have only slight atrophy and stiffness of the limbs, others have partial anchylosis with slight deformity, and others complete synostosis with deformity in bad position, but these last are the ones in which there has been no treatment or where it has been

begun late in the course of the disease. With proper treatment the deformity ought not to be great.

TREATMENT.—If a case in which hip joint disease is suspected is brought to the surgeon no delay should be allowed before commencing the treatment, even though it may seem advisable to treat the child by purely mechanical measures. The patient should immediately, during the process of construction of the brace, be placed in such a position as to relieve the joint from all functional activity. This is best accom-

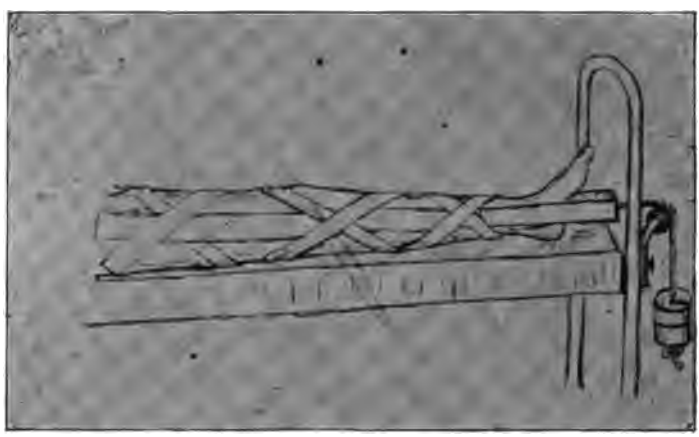


FIG. 156.—Arrangement for making continuous traction with the patient in bed. The foot of the bed should be raised from four to six inches by blocks.

plished by placing the child in bed, the use of the extension being applied in such manner that in whatever position he may be, whether lying on one side or the other, the extension is constant and always in line with the extension deformity. This is accomplished by the application of extension to the limb as shown in Figs. 156, 158. To a piece of board four or five inches in length, which goes across the sole of the foot without touching it, pieces of adhesive plaster are attached, so that they do not touch the malleoli and cause irritation, a hole being bored

through the middle of the traverse and the end of a rope put through and knotted. This rope runs over a pulley attached to the foot of the bed, and to the outer end of the rope is fastened a weight, varying according to the size of the child, from seven to fifteen pounds. If the disease persists and it is found that marked improvement does not take place in three or four weeks, it is generally inadvisable to keep the patient for a longer period confined to the bed, on account of lack of exercise and the consequent impairment of the health.

FIG. 157.—Deformity after coxitis.

As soon as it is ascertained definitely that a child has hip joint disease it is better to apply some form of apparatus which will carry out the indications for treatment and at the same time allow him to take exercise. It is doubtful if any form of external application is of much use. The joint is so far from the surface that even the old school authorities consider it of very little use to apply lotions or plasters or any form of counter-irritant. In some cases, when it may be inadvisable to apply walking apparatus, the plaster of Paris bed of Phelps, or Bradford and Lovett's bed frame, or the very excellent one of

Gorham, of Albany, may be used. By the use of these portable beds the patient may be moved about from place to place without disturbing the extension.

The treatment which allows of exercise and maintains extension at the same time is accomplished by the use of certain forms of splints or braces, which are mostly based upon the general plan of the original Davis splint. This has been considerably modified by Bauer, Sayre, Guerrin, Shaffer, Gibney, Taylor, and almost every orthopedist, although the original

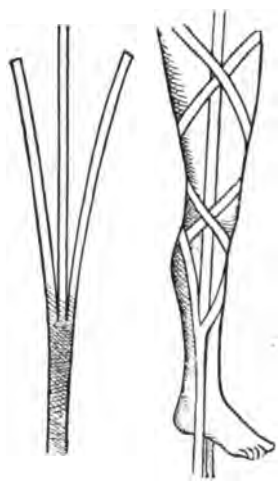


FIG. 158.—Adhesive straps applied for extension.

principle is still retained. All of these braces consist of a pelvic band of steel which extends partly around the pelvis, and from this a straight bar of steel extends along the limb to the foot. This may be arranged with a device by which it can be lengthened or shortened. From the pelvic band two padded bands pass just between the limbs under the perineum, so that the patient sits, as it were, in a saddle formed by the two perineal bands. The long steel bar which runs from the pelvic band to the foot is supplemented by a short piece which runs at right angles underneath the sole of the foot, and is

padded with rubber or leather. In order to make the extension, strips of adhesive plaster are applied to the limb, and to the lower end of the strips buckles are fastened. These buckles are attached to the strips of webbing which come up from the foot-piece. The extension is made by drawing downward on the adhesive straps and upward by the perineal

FIG. 159.—Taylor's hip joint splint with abduction screw.

bands. The result is that if these are drawn tightly the pressure of the femur in the acetabulum is relieved. To say that the head of the bone is actually drawn from the socket is incorrect, because the muscles about the thigh and hip are so large and strong that it would be impossible with the means at hand to separate the head of the bone from the acetabulum; it is only in theory that this takes place, but there is no doubt that

the traction which is made by means of the brace has a tendency to relieve the spastic contraction of the muscles about the joint, and thus lessen the irritation caused by the friction of the opposed joint surfaces. At the same time the brace acts as a perineal crutch and no weight is borne on the affected limb. The brace must be sufficiently long so that the cross-piece

FIG. 160.—Wilcox's hip splint.

which passes under the foot does not touch the sole. There should be a space of at least one inch between the sole of the foot and the top of the cross-piece.

There are many modifications of the brace described. In the author's brace there is, instead of the ordinary cross-piece for the foot, an arrangement which consists of a crutch

ferule with rubber tip, and connected by a horse-shoe-shaped piece of steel which passes behind the foot. The attachment to the plaster is made of elastic instead of leather, and the result of this modification is that the child can walk with his foot much nearer the ground, as there is no foot-piece to tread upon, while the constant traction of the elastic strap keeps up the extension, whether the child is walking or not. In the ordinary braces the steel extension bar and the pelvic band are fastened directly together. The result is that the joint in the brace is not over the hip-joint, and on account of the irritation caused by the presence of the pelvic band at a point so low down, it is almost always worn two or three inches above where it was originally intended, with tne result that the child is unable to sit down with ease, and the limitation of motion is very marked. To obviate this the writer has had constructed a brace which has the combined points of the Taylor and the Phelps brace. Instead of a single perineal band only a narrow round steel rod passes around the pelvis. The object of this is to make as little pressure as possible upon the prominences. Two other broader padded steel bands pass around the trunk higher up, to the lower of which the straps are attached. This is placed intentionally two or three inches above the joint around the waist, and another band still higher goes about the middle of the chest; these are all riveted to a perpendicular steel bar which passes down and terminates in a spur which extends to a point exactly opposite the hip joint. To this spur the long side bar is attached and is so arranged with a heavy nut that the joint may work freely or be set at any angle.

This brings the joint in the brace where it should be, *i. e.*, exactly opposite the hip joint, and thus obviates the interference with motion which occurs in the ordinarv braces. The

child is able to sit up on a level surface or even to bend forward without difficulty, while extension may be kept up to any degree. If desired, by simply tightening the nut at the joint, motion is absolutely prohibited, and all the benefit derived from the Phelps brace may be obtained. In applying it the perineal straps should always pass underneath the lower or pelvic band. The foot-piece, which has been described, makes it much easier for the child to walk than where the cross-piece is employed, and the elastic traction straps are preferable to the leather webbing straps, because the traction is constant whether

FIG. 161.—Thomas' splint applied.

the child is walking or not. In all the braces which are made on the principle of the long-walking splint the extension may be increased or diminished by lengthening the long steel bar. This may be done by means of a key and ratchet or by an endless screw, or any of the various other ingenious devices which aim at the same end. In severe cases of adduction of the limb which occurs in the third stage, Shaffer has used what is known as an abduction screw, which is a screw passing through the upper portion of the long bar and impinging on a plate fast-

ened to the pelvic band. As this screw is turned down slowly and a little at a time it has the effect of throwing out the lower portion of the brace and relieving the extreme adduction. Some form or modification of the long splint is most frequently used in this country, and for all-round purposes it is probably the best.

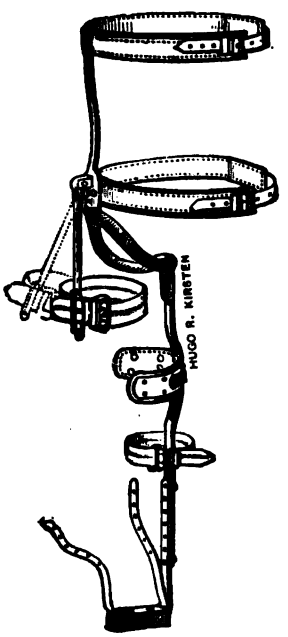


FIG. 162.—Phelps' brace for single and double hip joint disease.

In England, the Thomas splint which gives absolute fixation without extension is popular. It is believed better results can be obtained when the brace is left on at night; but sometimes, on account of the delicate skin of the patient and the child's intolerance of apparatus, it is necessary to give relief at night, and for that reason the brace is removed and extension with the weight and pulley employed. But the utmost care should be exercised that the patient should never at any time during the treatment be allowed to bear his weight on the diseased

limb. Phelps, of New York, treated the cases by absolute fixation in the joint, his apparatus extending from the axilla to below the foot so that the limb is kept in a state of extension without any motion whatever. He claimed better results from this method of treatment because by this means the func-

FIG. 163.—Phelps' brace applied.

tional hyperæmia of the joint is avoided, and he also claimed that a very small percentage of cases of ankylosis follows this treatment. It is, however, exceedingly awkward and difficult for a child to get about with an apparatus of this sort. He is perfectly rigid from the shoulders down, and sitting can only be done on one hip, and in a very awkward and strained po-

sition. He is obliged to walk about with crutches and a high shoe on the opposite foot, and retains the brace both night and day; it is doubtful whether the results obtained by this brace are any better than those by the ordinary brace, which allows motion. In cases which could not walk about, Phelps used a similar form of apparatus, but with a pulley which is placed over the side of the bed and straps which go around the upper part of the thigh in such a manner that when a weight is attached the extension is made laterally, with the intent to diminish the lateral pressure of the head of the femur in the socket.

The difficulty with all forms of braces which are applied to the limb by means of adhesive straps, or where continuous pressure is made for a long time with bands, as is the case with the perineal band, is that the skin becomes chafed and sore, and the child, especially in the summer, experiences great discomfort. In cases of chafing from perineal bands it is necessary frequently to let up the pressure for a while until the skin gets toughened, and the application of some form of astringent may be demanded.

For this purpose a solution of powdered tannin in hot water applied at night has been found to be as good as anything; sometimes alum does very well, but all oily or greasy preparations should be avoided. If the patient lives in the country where the white oak tree abounds, the inner bark of the tree may be removed and steeped in water until an infusion is obtained, which can be applied to the skin. This preparation is used in the country to apply to the necks of horses when they become galled by the collar in hot weather. Where the skin becomes sore underneath adhesive straps, the only thing to do is to remove them, and to re-apply the straps in some places where the skin is sound. In cases where the calf of the leg is

well developed, an accurate cast may be taken, and over this may be moulded a leather or felt legging, to which extension straps may be applied, the bulge of the calf giving sufficient resistance to keep the legging in place. Care must be taken that the straps do not draw the legging down on the ankle and cause ulceration of the skin over the bone. When the disease is far advanced and abscesses have formed, the condition is

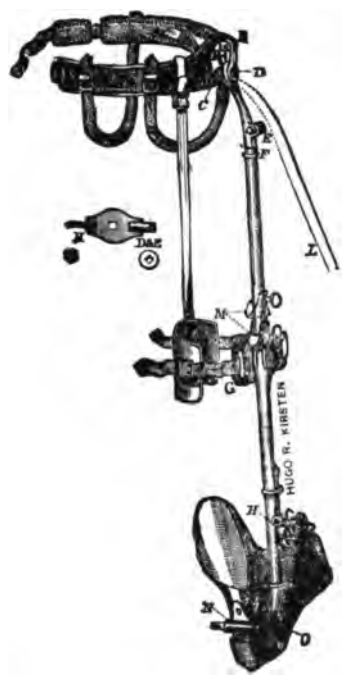


FIG. 164.—Sayre's long splint with shoe.

more serious. and the question of operative measures becomes an important one.

The discussion of the treatment of tubercular abscesses is given in another chapter, so that the details need not be given here. But the author reiterates his belief as to the injurious effects of the opening of cold abscesses, and protests against it, believing that by aspiration and injection of ethereal solution of

iodoform many cases may be cured within a short time, without the bad effects which follow the evacuation of the tubercular fluid.

OPERATIVE MEASURES.—Where a case has progressed so far that it becomes probable that no other method will bring relief, excision should be resorted to. The disease should not be allowed to progress to the extreme, but only so far as to indicate that it cannot be treated successfully by the more conservative measures, and that the ultimate result, if allowed to go on, will be either complete destruction of the joint or death

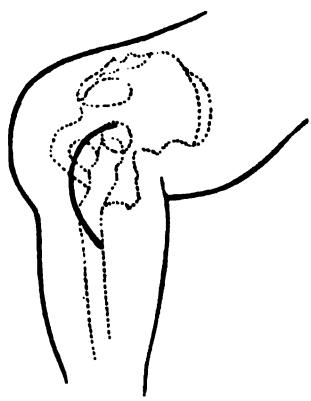


FIG. 165.—Posterior incision.

of the patient. As soon as this is determined the operative measure should be carried out. Indeed, by some surgeons it has been considered important that the operation should be performed at a very early stage of the disease, long before abscess has been formed, the idea being that at that time it is easy to cut down and remove absolutely the diseased focus and thereby obtain healing by first intention, and so reduce the duration of the disease to a very short period.

In this early operation the anterior incision is preferred, as it is much easier to get at the head of the bone than by the posterior (Fig. 165) or lateral incision. After the capsule has

been opened and the head of the bone exposed, any suspicious portions of the bone are carefully scraped out by means of the flushing gouge, which allows a stream of antiseptic solution to play constantly upon the surface of the wound while the gouge is being used. Then the leg is placed in the proper position and the wound allowed to heal. When, however, the disease has progressed to the stage of abscess and an operation becomes imperative, the lateral or posterior operation is better, and it is believed that better results may be obtained by the lateral or Langenback incision. (Fig. 166.) The reason for preferring this is that the fibres of the gluteus muscle instead of being cut transversely are merely separated, the incision being made in the long axis of the muscle, and it also gives a better opportunity for removing portions of the shaft of the bone if they are diseased than does the posterior incision. On the other hand, where only the head of the bone is diseased, it is much easier to remove it by the posterior incision than by the lateral, although the fibres of the muscles are cut transversely in making the operation. Preparatory to the operation all aseptic measures should be carried out, and after the anæsthesia is complete the patient be placed on a table, lying on the well side. The affected limb should be flexed to an angle of about forty-five degrees with the body.

This brings the fibres of the muscle directly in line with the longitudinal axis of the bone and allows them to be separated instead of cut across. For the lateral incision the knife is introduced about an inch above the great trochanter and is passed directly down into the joint and as far along the shaft of the bone as may be deemed necessary. As a rule, it is not necessary to ligate any vessel, although at first there may be sharp hæmorrhage from some small vessels. These can be controlled by means of forci-pressure applied for a short time. The flaps

should be retracted and the incision continued down through capsule and periosteum and the muscular attachments to the trochanters dissected off. If the bone is diseased under these muscular attachments the fibrous tissue may be easily stripped off with the periosteal elevator. If the underlying bone is healthy the removal of the muscular attachments is much more difficult, and they should be cut away with the knife, using great care to keep as close to the bone as possible. After the bone has been denuded and the joint has become accessible, the head of the bone or what remains of it can be turned out. All diseased portions should be removed, even though consider-

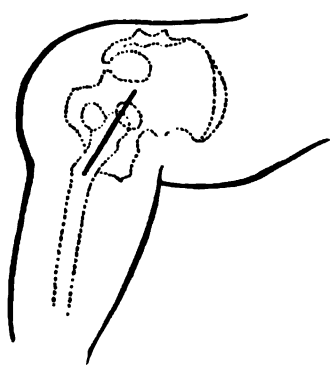


FIG. 166.—Lateral incision of Langenbeck.

able of the shaft must be taken. In some of the author's cases at least five inches of the upper end of the femur has been removed. Occasionally the bony tissue may appear to be healthy, while the medullary cavity contains gelatinous, unhealthy material. This should be scraped out by means of a long narrow curette, and excellent results are obtained by cleansing this cavity and filling it with iodoform powder. If the bones of the acetabulum are diseased they should be thoroughly curetted, as well as all the granulation tissue about the abscess cavity and the sinuses, and every vestige of diseased

tissue should be removed. This is important, because if it is not done, re-infection and a further continuance of the disease is likely to occur. The operation may be performed quickly. Vessels of any size that have been cut and which continue to bleed may be tied with catgut, or oozing of any extent may be

FIG. 167.—Sayre's wire cuirass.

stopped by the use of a douche of hot water which contains the tincture of iodine in solution. This iodinized water should be of a dark straw color, and should be as hot as can be used without affecting the tissues; it is a very rapid and effectual hemostatic. The wound should only be brought together suffi-

ciently so that there will be no gap, and one or more large drainage tubes placed down deep into the joint.

Three or four deep sutures and perhaps a few superficial sutures may be required to close the wound. Attempts at closing large wounds of this sort with the expectation of healing by first intention are apt to be followed by failure, because it is impossible to be sure that every vestige of the diseased tissue has been removed, and it is believed that the treatment described above is preferable. Sometimes it is better to pack with iodoform gauze than to use drainage tubes. Lately I have used folds of rubber tissue for drainage. For the after-treatment the patient may be placed in the wire cuirass of Sayre with extension of the limb (Fig. 167), or he may be placed in bed with the ordinary form of extension and sand bags placed at either side of the limb so that the leg is held in a straight position. It is believed that the use of the cuirass is attended with better results than is the other form of treatment, because when once in this apparatus the limb is kept immobilized and the patient can be moved about from one place to another, if desired. The stretcher shown in the chapter on Pott's disease of the spine may be used instead of the cuirass.

Extension should be kept up so as to avoid any unnecessary shortening of the limb, though, of course, shortening, where any great amount of bone has been removed, is unavoidable. Sometimes the wounds are a long time in healing, occasionally extending over a period of a year or more. This is probably occasioned by the fact that slight spiculæ of diseased bone still remain, and that it is necessary that these should be cast off before complete union can take place. However, it is the general result that immediately after the operation a patient begins to improve in health. Sometimes even in the most desperate cases, where it seems impossible that they can bear the shock of

an operation the relief experienced is immediate. In many cases where the temperature has been running from 102° to 103° every day, with signs of hectic and general consumptive tendency, the temperature drops at once to normal and remains

A B

FIG. 168.—Result of resection of hip joint. The upper portion of the femur being cut away below the trochanters. A. Showing amount of shortening. B. Showing amount of free motion at joint.

there, showing that an immense relief from sepsis has been given to the system; and although the patient may be long in obtaining absolute healing of the wound he will begin to show improvement from the first. The amount of shortening in different cases after operation varies.

In many cases there is shortening to the entire amount of bone that has been removed; in other there is a reproduction of bony tissues so that the shortening is very much less than would be expected. The limitation of motion is also variable. In one or two cases which were most unpromising before the operation, motion was perfect in every direction, although there was shortening of the limb.

FIG. 169.—Recent case after resection of hip joint by the author about on crutches with Thomas' brace.

In cases of ankylosis following hip joint disease, where the ankylosis has taken place in an unfavorable position, the only remedy is osteotomy. Osteotomy may be performed by the chisel and the limb brought into the straight position. This is safer and better than the attempt to relieve the ankylosis by fracture. In all cases of hip joint disease, whether treatment

has been by means of the brace or by operation, the child should be carefully watched for several years, because there is always a tendency for the disease to return unless great care is taken, and the splints should never be removed until it is certain that the recovery has been complete. In cases where there has been shrinkage of the limb with a lack of development of the muscles, much may be done by the use of electricity, baths and massage. These should be kept up until the nutrition of the limb is thoroughly restored and the strength is equal to that of the other side. Where there is actual shortening it is best to equalize the length of the limbs by the use of a high shoe on the affected side. In this way the tendency to static curvature of the spine is avoided and the patient walks with very much greater ease than if it were not applied.

NON-TUBERCULAR DISEASE OF THE HIP JOINT.

Lameness of the hip joint may occur as a result of colds, strains, contusions, etc., which may not be reported to the surgeon. The symptoms may closely resemble those of an incipient hip joint disease, and the lesion may cause a spot of diminished resistance, and may, if uncared for, act as an incubating site for a tubercular colony. Therefore, it is always well to treat such a case as though the lesion were a serious one, and, at least, put the child to bed even if the extension apparatus is not applied. There is certainly no harm done by following this rule, while, on the other hand, serious after-trouble may be avoided.

COXA VARA AND COXA VALGUM.

It is always well to remember the possibility of the occurrence of either one of the above diseases which result from the change in angle at the junction of the neck and shaft of the femur. In coxa vara the angle is lessened, and the limbs can not be abducted, while in extreme cases they are adducted so that they assume the position known as scissors legs. Walking is difficult and abduction is impossible. It may occur in childhood, but, as a rule, more commonly at the beginning of puberty.

In coxa valgum the angle is increased. It is a rare condition, and may occur as a result of disuse with long-continued traction.

CONGENITAL DISLOCATION OF THE HIP.

Congenital dislocation of the hip is not infrequent. It differs from an ordinary dislocation in that there is no rupture of the capsule, and also that the head of the femur escapes easily from the acetabulum on account of the abnormal shallowness of the socket.

Three theories are given to account for this condition. The causes mentioned are heredity, mechanical intra-uterine pressure, or traumatism, pre-natal disease, and arrest or defect of development.

Examples of the frequency of cases in one family are cited to establish the theory of heredity. The theories of mechanical intra-uterine pressure, or traumatism from diminished quantity of liquor amnii, or from a blow or fall on the mother's

abdomen, do not appear to have sufficient proof to sustain them. The theory of pre-natal disease has many supporters, and it is supposed that some pre-natal nervous condition affects the muscles, causing abnormal contraction and dislocation. The fourth theory is now the most widely accepted, and is supported by the fact that the acetabulum is not sufficiently developed to hold the head of the bone in place.

The most frequent congenital dislocation is seen when the head of the femur lies upward and backward on the dorsum of

FIG. 170.—Congenital dislocation of right hip.—Phelps.

the ilium; but sometimes the displacement takes place toward the pubis, or into the obturator foramen or downward and backward.

All the parts composing the joint ordinarily are present except the ligamentum teres, which may be lacking, but the acetabulum is shallower, flatter and proportionally smaller than usual, and may be triangular. It may be filled with fat and connective tissue in infants, but in adults it may be filled with exostoses. Depressions may exist on other portions of the

pelvic bones where the head of the femur has rested. The head of the bone is smaller than normal, but proportionally larger than the acetabulum. The neck of the bone may be short or wanting. The ligamentum teres is long and thin or sometimes wanting. The capsule of the joint is enlarged, thickened and relaxed, and the body is suspended on the elongated capsule as shown by Volkman, like the old-fashioned stage coach on leather springs. The pelvis may change in

FIG. 171.—Congenital dislocation. Rear view.—Phelps.

shape but not sufficiently in the female to interfere with parturition. The gluteal muscles become atrophied.

The most prominent symptoms are the extreme lordosis and the peculiar "goose gait." The lordosis varies according to the amount of displacement, and is due to the effort of the child to preserve its equilibrium. The gait is waddling or lurching. There may be no pain, but the patient tires easily in walking. As the child grows older, however, there may be a great deal of pain, and the patient become practically disabled from walking. The condition may not be noticed until the child begins to walk, and the displacement of the trochanters, especially in

cases of double dislocation, may not be discovered until late. The children are especially subject to sprains and wrenches.

The chief diagnostic points are the position of the trochanter above Nelaton's line and the possibility of its being drawn down to its proper position by gentle traction. The extra breadth of the perineum, the extreme lordosis, the abnormal mobility of the joint, and the waddling gait are also important diagnositic points.

Of the treatment Bradford and Lovett (1) write: "When

FIG. 172.—Double congenital luxation before operation.—Hoffa.

one considers the problem to be solved in the treatment of congenital dislocation of the hip it is easy to see why the remedial means proposed are in general so inefficient; an imperfect acetabulum, perhaps almost wanting, a flattened and deformed head of the femur, and strong muscles and body-weight antagonizing every therapeutic measure."

Continuous extension over a period of two years or more has been the method mostly employed, and a number of cases of alleged cures by this method have been reported, but some have been discredited. Brown, of Boston, was the first to

achieve success by this method in a case of a patient four years of age with congenital dislocation of both hips. The child was kept in bed for thirteen months, and constant traction made by weights and pulleys. Then the wheel crutch was employed, without allowing her to rest her weight on the floor, and the cure was complete at the end of three months. Bradford, of Boston, has also been successful in the treatment of this condition by means of continuous extension.

Various kinds of apparatus have been tried to maintain the

FIG. 173.—Double congenital luxation of hip, after operation. Side view.—Hoffa.

head of the femur in position, and these have consisted of some form of jacket or brace which encircled the lower portion of the body and extended well down over the hip. All of the mechanical measures for the treatment of this dislocation are admitted by orthopedists to be largely unsatisfactory in their results. Within the past few years operations have been performed with some degree of success.

The operations vary somewhat. Hoffa, using the Langen-

beck incision, cuts down and frees the trochanter from the soft parts and muscular attachments, and then scoops out the acetabulum with a curette in order to deepen it. The dislocation is reduced, a flap is turned up from the bottom of the acetabulum to surround the head of the femur, and the limb is held in position by a plaster of Paris splint.

Lorenz's operation differs by having an anterior incision down to the joint. The acetabulum is hollowed out and the reduction of the dislocation effected, and the limbs placed in slight abduction in plaster of Paris splints.

FIG. 174.—Double congenital luxation of hip. After operation. Back view.—Hoffa.

Bradford's operation is much like that of Lorenz, but finds by careful dissection that the chief obstacle to reduction is the tension of the ilio-femoral or "Y ligament of Bigelow." Therefore he makes his incision somewhat more laterally than that of Lorenz, and adds a cross incision for the purpose of releasing the tension of the above-mentioned ligament.

Lorenz's so-called "bloodless method" has of late years occupied the stage. It may be done successfully, and the

younger the children the easier it is to do: after six years of age a good result is rare.

The steps of the operation are as follows: Complete anæsthesia, strong flexion of thigh, slight rotation internally, and then strong abduction, forcing the head of the bone into the socket.

While held in above position the thigh and lower half of body are encased in plaster of Paris, which is kept on from three to six months.

The plaster of Paris is then removed and a re-application made for three months more. Child may walk about during this time with knees bent. Afterwards manipulation and massage are used to strengthen the muscles.

Dr. Russell A. Hibbs, of New York, claims superior results by "An Original Method of Operating for Congenital Dislocation of the Hip Joint" (N. Y. Med. Jour., April 25, 1908) in uncomplicated cases up to four years of age. Without an anæsthetic and with it in older cases, the head of the bone can be forced down below and behind the acetabulum. Knowing this Hibbs devised a table and apparatus to hold the pelvis immovable, and a pad so arranged that steady pressure is made on the trochanter to force the head of the bone into the socket while the thigh is extended and adducted. Then the limb is put up in a plaster cast, which is kept on for two weeks. Then it is removed and the limb brought still further into the correct position and changed every two weeks thereafter for about three months, when the cure should be complete. Hibbs reports cures of fourteen congenitally dislocated hips in thirteen patients.

KNEE-JOINT DISEASE OR WHITE SWELLING.

Knee-joint disease may occur at any age, but it is most frequent in young children or in young adults. It may originate either in the bone, the synovial membrane, or in the articular cartilages. In youth it originates about equally in the synovial membrane or in the bone, but in the adult more frequently in the synovial membrane. The cases in which the disease begins in the articular cartilages are rare, but they occur occasionally. The general causes are much the same as in hip joint disease, but a larger proportion of cases originate in the synovial membrane on account of the greater surface which is more exposed to injury. The pathological conditions are similar to those of hip joint disease, which need not be noted at length again.

The ordinary division into three stages prevails. In the first stage, in which the disease is slow in its onset, the symptoms may be of an indefinite character; the patient may show no particular signs of constitutional illness, but frequently there is a condition of malaise, the patient seeming to be in low tone and slightly out of health. There are symptoms of stiffness and lameness, the stiffness being especially apparent in the morning but perhaps passing off later. There may be a slight limp which comes from the pain or inflammation caused by motion. This may pass off after the patient has slept and rested for a few hours, but becomes more apparent later in the day. The pain is transient and recurrent and more or less erratic, is dull and aching in character, increased by motion, and there is tenderness on pressure about the internal condyle about a half inch above the patella. Later on the knee is flexed on account of the spastic contraction of the muscles about the joint, and this flexion and the stiffness which accompanies it

cause a practical shortening of the leg. The swelling is peculiar, it is uniform, giving a rounded appearance to the knee, the prominences becoming lost in th general rotundity; the swelling is doughy, not œdematous, and feels as though the joint were full of a thick gelatinous material. The color of the joint is not such as usually accompanies an inflammatory condition, but there is rather a lack of color; the joint has a whitish hue with blue veins running over the surface, and the temperature, instead of being above the normal, is more likely to be below. Constitutional symptoms are not present to any marked degree.

The second stage is usually ushered in by the nocturnal cry,

FIG. 175.—Eversion of foot in knee joint disease. From plaster cast by Sayre.

which is indicative of destruction in the bone. The patient suffers from pain on motion, the pain is exceedingly severe, and the patient naturally dreads any motion; the tendency to keep the joint rigid is involuntary. Later on there may be an abnormal movement, which comes from the destruction of the inter-articular structures or those within the joint, and this allows passive motion to be made in unusual directions and is accompanied by a grating of the bones, or crepitus. The constitutional condition also evinces signs of advanced disease, as fever, emaciation, debility, and all the symptoms which characterize a severe form of articular disease. At this,

the third stage, abscesses develop and the pus may burrow down under the tissues opening at a point considerably distant from the joint. This pus is like that which is found in all cases of tubercular joint disease, and may be thin, serous and filled with large flocculent masses, and sometimes tubercular bacilli are found in it.

There are peculiar appearances which accompany the disease of knee-joint, as the eversion of the foot (Fig. 175), which is the result of the contraction of the ham-string muscles, with a tendency to pull on the outer head of the tibia and rotate the foot outward; also the flexion caused by the spastic contraction of the muscles, and the constant traction of these muscles induces a subluxation of the head of the tibia backward on the condyles of the femur. This gives rise to a peculiar overhanging appearance of the femur, making the joint appear much more prominent in front and the swelling apparently much greater than it actually it. There is decided shrinking of all the muscles above and below the joint, this being one of the characteristic symptoms of the disease, and this shrinking of the limb adds to the undue prominence of the joint itself. The symptoms in the case of tubercular disease of the joint differ from those of an ordinary synovitis in that the onset of a synovitis is rapid and exceedingly painful from the first, and is either the result of an injury or a cold, or perhaps of rheumatic or specific conditions, while the tubercular disease is exceedingly slow in its onset and lacks some of the symptoms of active inflammation. In synovitis there are the rapid swelling, the great pain, the heat, the soft fluctuating tumor and absolute loss of function; in the tubercular disease in the early stages there is the lack of great pain, there is no heat, motion is limited, but not lost at first, and the swelling is "doughy." In some cases the disease may run its course without suppura-

tion, or it may undergo cheesy degeneration and absorption without the formation of pus. If recovery takes place it occurs by a general remission of the constitutional and local symptoms, with increased appetite, better sleep and improvement in every other direction, and ankylosis will be the result. If the disease has progressed to a stage of suppuration where destruction occurs, there are all the symptoms which occur in any advanced tubercular disease,—night sweats, fever, loss of appetite, diarrhœa, great exhaustion, amyloid disease of the kidneys and general tuberculosis.

When a child shows the early symptoms of knee-joint disease the gravity of the situation should be explained to the parents and immediate steps should be taken to prevent further

FIG. 176.—Double extension of Sayre.

advance of the disease. As in all joint diseases, the principal thing to avoid is functional activity. If a child with incipient knee-joint disease walks about every additional step excites the already existing inflammation, and the limb should be kept as quiet as possible and no weight should be allowed to be borne on it until the disease has disappeared. It is not always necessary to put a child to bed with disease of the knee-joint, but he may have some form of splint which will immobilize the joint and allow him to go about on crutches, with a high shoe on the opposite foot. The form of splint which may be used in this case consists of a simple poro-plastic splint of felt, or one of leather or plaster of Paris, or perhaps a steel brace, which is arranged with straps to immobilize the joint. In tubercular disease, however, even immobilization alone is hardly

sufficient to effect a cure. It has been found that tubercular bacilli do not develop at a low temperature, and as the knee-joint is easily accessible the continuous application of cold can readily be made to this vicinity; so that one of the best means of prevention of the tubercular development is by keeping the knee-joint constantly wrapped in ice bags. These should be kept on continuously for weeks and even months. In one of my cases the application of ice was made continuously for over nine months with good result. This form of treatment is bothersome on account of the leaking of the ice bags and the constant attention which they require to keep them

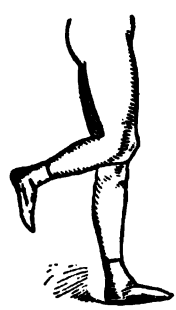


FIG. 177.—Ankylosis following knee joint disease.

filled, and it is apt to be neglected unless the parents are thoroughly imbued with the idea of its necessity. Exactly the opposite method may be used in applying the "Bier's treatment." Where the disease has progressed so that the patient suffers from pain it may be necessary to apply some form of extension. There are many forms of apparatus having this object in view.

The best results are obtained by the same form of brace which is used in disease of the hip joint, because sufficient extension can thus be obtained and the patient can walk about without the use of crutches; and the treatment by this means is

in every way much more efficient than by means of the short knee braces. In the early stage application of iodine ointment may be applied, and should be rubbed in night and morning, just avoiding blistering the skin. The tincture of iodine is too strong; it causes blistering and hardening of the epidermis, which loses its powers of absorption, while the iodine ointment is much more readily absorbed and does not cause vesication. When the deformity appears with the eversion of the foot and the overhanging appearance of the condyles of the

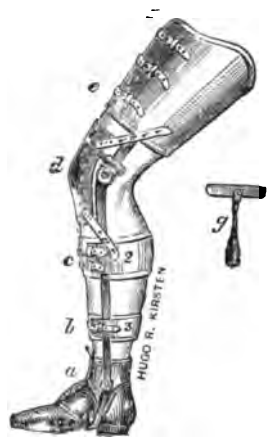


FIG. 178.—Traction screw apparatus for ankylosis of knee joint.

femur another form of extension must be employed, and the double extension of Sayre, which is used in bed, may be tried; or Stillman's knee brace with posterior spring and pad. If an abscess appears then the etherial solution of iodoform in the method already mentioned, or the use of iodoform and oil, should be tried; or, if it is necessary to take more active measures, excision or erasion of the joint may be considered. If these are not sufficient, the only remedy remaining may be amputation of the limb, which, of course, should be employed only as a last resort.

There are serious objections to excision of the knee-joint in a child. The epiphysial line is from three-quarters of an inch to an inch from the articular surface, and it is from the epiphysial line at the knee-joint that the longitudinal growth of the bones take place. If these epiphysial cartilages are removed the bone will cease to grow in length, or, at least, its growth will be very much interfered with. If possible, excision should be delayed until full growth of the bone has been attained. And if the head of the bones be seriously affected with tubercular disease it may be impossible to remove the entire focus of the disease without removing the epiphysial cartilages. In two cases the author has been obliged to amputate at a point higher up after it had seemed that all the diseased

FIG. 179.—Schematic representation of excision in angular ankylosis of the knee.

portion of the bone had been removed. If it is not removed sufficiently the disease reappears in a short time, even though primary healing may apparently have taken place, amputation is the only remedy. The operation of excision is easily performed. Beginning at the inner condyle the semilunar incision is carried down half an inch below the patella to the corresponding point on the opposite condyle. The flap including the patella is dissected up; the lateral ligaments are divided and the condyles of the femur and the head of the tibia are freed from their attachments. Then the head of the tibia and the condyles of the femur are sawed off so as to give a straight leg when the ends of the two bones are applied to each

other. They may be fastened in position by silver wire, or perhaps by what is better, kangaroo tendon. This tendon will last as long as is necessary in the tissues, and will finally dissolve and completely disappear.

Erasion is now considered more favorable to recovery than excision, but it must be done thoroughly. If the disease is cured by ankylosis and in a bad position the excision of a wedge-shaped portion of the bone may be practiced.

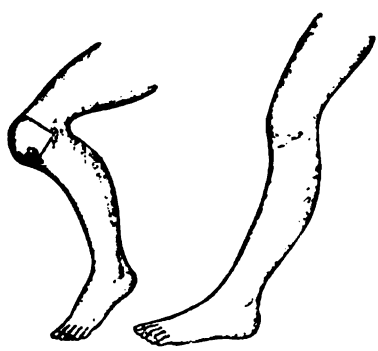


FIG. 180.—Wedge-shaped excision in right angled ankylosis in the knee; before and after operation.

In some cases, tenotomy of the hamstrings may be all that is required to allow the leg to come straight. In some cases it is inadvisable to attempt any operation even though the limb is crooked. In such a case such apparatus as will aid the patient in walking should be used, and one which allows the weight to be supported by the thigh instead of by the ankylosed joint is the best.

In mild cases of fibrous ankylosis gradual extension by some form of apparatus may be employed.

KNOCK-KNEE OR GENU-VALGUM.

Knock-knee is a condition where the knees fall within a line drawn from the head of the femur to the ankle. Sometimes the knees may merely strike together; sometimes they overlap, or the ankles may be wide apart. This may result from two causes; either from increase of growth of the inner condyle of the femur, or there may be a laxity of the internal lateral ligaments of the knee-joint which allows a space to exist between the inner condyle and the head of the tibia. When this laxity of the internal lateral ligaments is present, continual pressure is brought to bear on the outer condyle of the femur, which results in preventing its development, while the lack of pressure on the inner condyle allows it to develop unduly. A rachitic curvature of the legs may also be the cause of knock-knee.

It may exist in almost any degree, from a slight knocking together of the knees to the most exaggerated crossing of the legs, so that one knee crosses over the other, and the outsides of the feet are in apposition instead of the inner. Such a deformity is known as "scissor-legs." Knock-knee is almost always, in rachitic cases, accompanied by flat-foot, which is the result of weakened muscles on the anterior portion of the leg. It is usually found in children whose limbs are not fully or equally developed. Occasionally a strong, well-developed child will have knock-knee, but in such cases it seems to be due to an increased development of the outer condyles. The joints are exceedingly large, and it is probably due to rachitis. Where the internal lateral ligaments are weakened it is due to a low tone of the system; the ligaments are lax, which allows the leg to be moved laterally, so that a decided space may be found between the internal condyle and the inner edge of the head of the tibia.

The diagnosis is easily made. The patient is laid on his back and the limb are kept perfectly extended; any attempt to bring the ankles together may result in failure on account of the prominence of the knee-joint. But if the ligaments are very lax, or the deformity is not very severe, it may be accomplished. One may be deceived into thinking that the deformity may be easily reduced if the limbs are not kept perfectly extended because the increase in length takes place on the lower end of the condyle and not posteriorly, so that when the limb is slightly flexed another angle of the tibia with the femur is assumed and the leg becomes straight when viewed from the

FIG. 181.—Knock-knee.

front; but when the extension is again made it will be found that the deformity has returned. This is a point of great importance, not only in making a diagnosis but also in the treatment. Where the case has gone on for a considerable time and the ligaments are strong it may be impossible to restore the deformity or obtain any lateral movement at the joint. In cases where the deformity is slight it may cause little difficulty in locomotion; but if accompanied by flat-foot on one side and a normal condition of the limb on the opposite side it may lead to static curvature of the spine, as has been shown in the chapter on Lateral Curvature of the Spine. The gait of

the patient may be rolling, on account of the difficulty of getting one knee past the other.

When occurring in young children, even in quite pronounced cases, the difficulty may be easily remedied if the constitution of the child is not greatly affected, for frequently this occurs

FIG. 182.—Knock-knees, rachitic.

in children who are apparently otherwise strong and hearty. This should be borne in mind in making a prognosis. Where there is no bending of the bones from rachitis the limbs can be straightened by the use of braces if attempts are begun when the patient is young; and often in cases where the condition is a

mild one it may be possible to restore the limb by manipulation alone. The simplest form of treatment is by means of massage, galvanism, and frequent application of pressure to the condyles. This may be accomplished by putting the patient in the upright position, and taking a large flat cork or pad, about three-quarters of an inch in thickness, having it hollowed a little at the sides in order that these may act as receptacles for the condyles and placing this between the knees, with the ankles pressed together. This has a tendency to stretch the external lateral ligaments, while it relieves the laxity of the internal lateral ligaments and brings pressure to bear upon the internal

FIG. 183.—Manual correction of knock-knee.—Hoffa.

condyle. It should be done several times a day and the patient allowed to stand for a few minutes in this position, care being always taken that the limbs are in a completely extended position and not in the slightest degree flexed when this application is made. If there is also a condition of flat-foot or any other deformity present it should be attended to. In the more severe cases the application of a brace is called for. There are a large number of braces for the correction of this deformity, many of which are excellent in their methods, and some of which are exceedingly faulty. The great difficulty with a large number of braces is that they consist of a combination of steel bars and straps which encircle the leg and are so arranged as to draw

the leg toward the steel bar; this necessitates the passing of a band around the leg, especially around the knee-joint, and makes a pressure upon the popliteal space. Pressure at this point cannot help interfering with the nutrition of the limb, because it must press upon the arteries and vessels and cause more or less interference with the circulation. This is a serious fault, and on account of this difficulty it is often impossible to keep up the continuous pressure on the inner side of the joint.

Various means have been employed to remedy this defect in

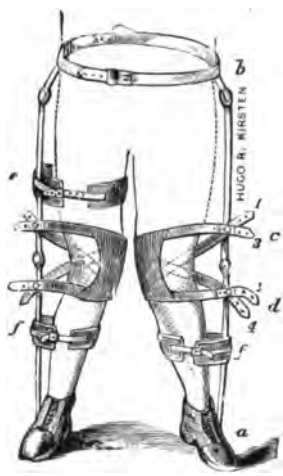


FIG. 184.—Double brace.

the braces, but it is impossible to do so with straps passing around the limb, or to gain pressure of any service on account of the pain which is caused by the pressure in the popliteal space. Another thing which must be borne in mind is that whatever form of brace is placed upon the patient's limb he is made to walk about with the knee perfectly straight; the limb must be rigid from the hip to the ankle, because the moment the leg is allowed to be flexed it brings it into a different line and in a place where pressure is not brought upon the internal condyle. For this reason braces which have the effect of keep-

ing the leg perfectly straight are the ones which should be used but it is necessary at the same time that the patient should be allowed to move his limbs at certain times during the day. The joint cannot be maintained in a stiff position constantly, nor can the brace be always removed to easily accommodate the necessity for moving the joint. It is better if

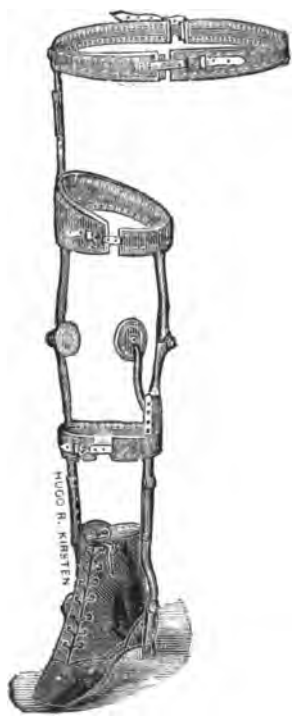


FIG. 185.—The author's knock-knee brace.

the braces are worn constantly, night and day, although that will not be tolerated by some patients. Where it cannot be done they should be worn at all times when in an upright position. In order to facilitate this treatment and keep the brace on at all times, it is necessary to have it arranged in some way so that the shoes and stockings may be removed and the brace left in position. Also, in order to gain sufficient pressure, it is

necessary that braces should run from the pelvis to the ankle; short braces have very little effect as they cannot give sufficient leverage without being applied very tightly. The best brace is one which is made to use without pressure from the straps which encircle the limb, but which takes its pressure from a bar on the inner side of the limb, and one in which the leg can be perfectly loose except at the points where the pressure is made, that is, at the outer side of the leg and thigh and across the inner condyle.

To obviate the various difficulties which have presented themselves from time to time in treatment of cases of this sort the author has devised a brace which he thinks meets the requirements. It consists of a pelvic band with a bar running along the outer side of the limb, fastened to the shoe; this bar is jointed at the hip, knee and ankle; on the inner side of the limb is also another bar, but shorter, as it cannot be attached to the pelvic band; this is united to the external bar by semi-circular bands above and below the knee, and is also attached to the shoe; one or two straps encircle the limb *loosely,* these being necessary to hold the bar in position Pressure is made against the knee-joint by means of a lever and pad which spring out from the inner bar, the pressure being regulated by means of a screw so that any amount of pressure desired can be brought upon the joint. The joints at the knee may be locked by means of a short bar of steel, which is so arranged as to hold them in a straight position, the knee being held straight by means of a knee-cap. By this apparatus it is possible to gain any amount of pressure desired; the patient can walk about with the knees in a straight position, and there is no pressure at all on the popliteal space, while by removing the steel lock-bar at night, when the patient is lying down with the splint applied, he may be allowed to bend his knees as fre-

quently as desired. As before remarked, it is better that the patient wears the brace night and day, but in case he does not the apparatus described can be used during the day or whenever the patient is in an upright position. The author has been able to cure severe cases in young children inside of three or four months with this apparatus. Others, on account of the irritability of the child and the lack of discipline on the part of the patient, frequently require a much longer period. This brace has always been found exceedingly satisfactory. Of course,

FIG. 186.—Unilateral knock-knee before osteotomy.

the application of massage and electricity and the general treatment of the patient's condition must be attended to carefully at the same time. In the more severe cases, in which the bones have become hardened and the ligaments strongly contracted, and perhaps accompanied by some deformity of the bones themselves, it may be necessary to resort to more radical measures, and either osteoclasis or osteotomy may be required.

OSTEOTOMY.—Where a curvature of the bone exists from

rachitis this form of treatment will become absolutely necessary after hardening of the bones has taken place, and where there is a decided length of the internal condyle which has persisted beyond the time when treatment by means of the braces is of avail, osteotomy should be performed. This is, as a rule, a safer, more expeditious and surer treatment than osteoclasis, because where the chisel is used the bone can be divided exactly at the point where the operator desires; but where the machine for fracture is applied other structures be-

FIG. 187.—Unilateral knock-knee after osteotomy.

sides those upon which the operation is performed may be injured, and it may not be so easy to fracture the bone at exactly the desired point. The advantage of breaking the bone is that there is no external wound; though with antiseptic precautions very little danger may be apprehended from the use of the chisel. Various points may be selected for the division of the bone, but the most frequent one is about one inch to one and one-half inch above the joint, through the internal condyle. The limb is rendered aseptic, then it is placed on two or three sand-bags, so that it is perfectly embedded and rendered

perfectly solid for the use of the chisel. The incision through the skin may be made with the knife, or the entire operation may be performed with the chisel. These chisels or osteotomes are of different sizes and thickness. After the incision is made through the skin down to the bone the chisel is applied at the point desired and driven by the mallet down into the bone as far as is necessary. As a rule, it is unnecessary to drive the chisel clear through the bone, because when the bone is partly cut through it may be bent into shape, or the fracture completed by the pressure of the hands. Sometimes it is difficult

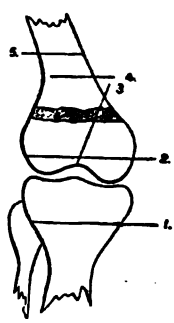


FIG.—188.—Lines of incision osteotomy for knock-knee. 1. Mayer, Billroth, Schede; 2. Annandale; 3. Ogston, Reeves, Chene; 4. Macewen; 5. Taylor.

to get the chisel out of the bone because it has become wedged in place, when great care must be used lest the chisel be broken off; it must be pulled out in a straight line, or if it must be moved from side to side to loosen it, it must be done edgewise.

The directions given by Macewen are to withdraw the chisel by means of pressure of the hands, by grasping it as close to the limb as possible, and then by shutting the hand tightly, the pressure caused by the contraction of the muscles will tend to raise the chisel out of the groove. The "V"-shaped opening in the bone caused by the entrance of the chisel is usually sufficient, without removing more bone, to have the limb brought

around in a straight position, and it is on this account that the application of the chisel is made to the internal condyle rather than the external.

The bleeding is sometimes profuse at first, but as no vessel of any size is cut it is soon stopped by pressure. After the removal of the chisel the limb is brought into correct position; a wet bichloride dressing is applied over the wound. The limb should then be placed in a straight position, and a plaster of Paris bandage applied. I always employ the plaster of Paris bandages wet in 1-2000 solution of bichloride of mercury; this makes a perfectly aseptic bandage, and need not be removed for ten days or two weeks, or perhaps five or six weeks if it is necessary to retain it so long. Plaster of Paris makes as perfect an aseptic dressing as can be procured, not only from the aseptic qualities of the plaster itself, and the bichloride of mercury which is used in moistening it, but, because of the stiffness and immobility of the dressing, healing takes place rapidly. If swelling or inflammation occurs it may be necessary to split the dressing down the front or on the inside of the limb. As a rule, this will not be necessary because a plaster of Paris bandage instead of shrinking becomes slightly larger as it dries, the result being that there is more room after the splint is thoroughly dry and hard than when it is wet. Frequently, by lifting the limb, the force of gravity is sufficient to prevent any congestion of the extremity; but rather than run any risk it is better to slit the bandage and then afterwards apply another layer of plaster of Paris, which will retain the splint in positon, although a little looser than it was originally.

GENU-VARUM OR BOW-LEGS.

In bow-legs the knee-joint falls outside of the line drawn from the head of the femur to the ankle, or where an outward curvature, more or less pronounced, exists in the bones of the leg or thigh. In some cases the bones may be straight, but if the deformity be due to an increase in the length of the outer condyle of the femur the joint makes an outward angle instead of a curve. Bow-leg is a condition essentially the result of rachitis. The curve in the bones may exist in the tibia and fibula or the femur, or all, and may vary from a slight curvature of one bone to a very pronounced curvature of all the bones of the lower limb. Sometimes the curve is so great as to almost form the letter "O," the two limbs being symmetrically curved.

Different causes have been assigned for the presence of bow-legs, but it is generally considered that the effort of standing when the bones are inclined to be rachitic is the usual cause. In some cases the legs have been found bowed before the child commenced walking, supposed to be due to the fact that strong muscular contractions have bent the bone; but these cases are rare, and in almost all cases the curve appears at about the time the child begins to stand. Such cases are doubtless rachitic in origin. The gait of a bow-legged child is peculiar; he walks with the feet wide apart and the knees flexed; the toes may be turned in and lordosis of the spine may also be present, and he walks with an awkward gait. Occasionally, but very seldom, there will be genu-varum on one side and genu-valgum on the other, but such cases are exceedingly rare. Occasionally there is anterior bowing of the tibia. The period of increase or decrease of the bowing of a child's legs

is during the first four years of his life. The bones are soft and take shape according to the direction in which the bone yields most readily. This softening may continue up to the age of from two to four years, when the bones become hard. After that time there may be excessive hardening of the bone, or "eburnation." In this condition the bone becomes harder than normal, and it is impossible to expect a change in the shape of the limbs after this period, or to straighten the bones by means of braces.

For some unknown reason some cases of bow-legs get well

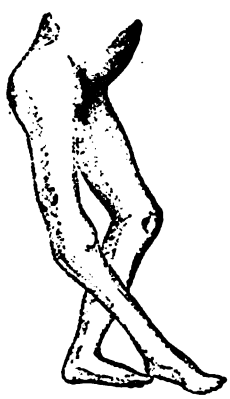


FIG. 189.—Genu recurvatum.

spontaneously at an early age, but no data can be given by which one can decide that a case will continue in the deformed condition or that the legs will become straight without treatment, so that it is always better, in order to be on the safe side, to begin the treatment at as early an age as possible. In order to keep a record of the progress of the case it is well to make a drawing of the child's limbs. This can be done by setting the child down on a piece of paper and making tracings of the limbs as they are pressed down. Further tracing can be taken from time to time which will indicate the increase or decrease of the deformity. During the bowing age, or between two

and four years, much may be expected by the use of braces, and we may, as a rule, offer the hope that the cause may be cured by braces alone; but after that age nothing farther can be accomplished by this means, and only operative measures will be of any service.

There are several varieties of braces which can be used, the object being to make continuous pressure upon the curve, and by this pressure to press the limb inward. These should be ap-

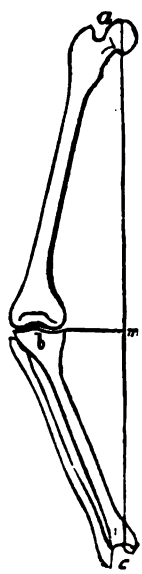


FIG. 190.—Showing degree of curve.

plied as early as possible and kept on until the limb is straight. As a rule, where the bone is bent anteriorly in the tibia it is much more difficult to affect it by the use of braces, but sometimes if the treatment is begun quite early a good deal may be accomplished. The general health and the improved nutrition of the patient have much to do with the progress of the disease, and as rachitis is essentially a condition of mal-nutrition, it is probable that under improved hygienic conditions and the improvement of the patient's general health a change in the

bone formation may be brought about, so that the correction of the deformity is more easily effected. It is a question how much may be accomplished by remedies and food, and it is

FIG. 191.—Bow-leg brace.

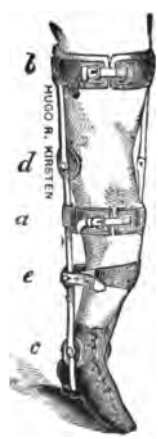


FIG. 192.—Bow-leg brace.

well to bear in mind that certain drugs may have the effect of producing rachitis. Heitzman has told us that he has produced rachitis in rabbits by giving them lactic acid for a prolonged period, and it is possible that there are other remedies that

have the same effect. We know that silicia and calcarea and certain other "tissue remedies" have a curative effect on the tendency of rachitis. The operative treatment may consist of osteoclasis, osteotomy or osteostomy. Osteoclasis consists of breaking the bone and restoring it to the correct position. This may be done by the hands, or it may be accomplished by any of the various forms of oteoclasts.

Manual fracture is not as accurate as with the use of osteoclast, because it is impossible to regulate the force with such certainty as with the use of the apparatus; still it

FIG. 193.—Anterior curvature of bones of legs.—Ashhurst.

may be tried in cases where it is impossible to have the osteoclast. After the fracture the limb should be placed in a retentive dressing—plaster of Paris being generally used and the best. The after-treatment is about the same as the treatment of any ordinary fracture of a long bone, and should be carried on on about the same principles. The operation of osteotomy should be performed with the utmost antiseptic precautions. The limb should be placed upon a sand-bag and an incision made longitudinally through the soft portions, the chisel introduced, and then turned so that its edge is across the bone. The mallet is then applied until it is found that the bone has

been cut through. It is not always necessary to completely sever the bone with the chisel, but only to cut it sufficiently so that the remaining portion can be fractured by the hands.

The operation of osteostomy is performed by the removal of a wedge-shaped piece of bone from the convexity, sufficient to allow the legs to be brought into straight position. In order to determine the amount of bone which should be removed the

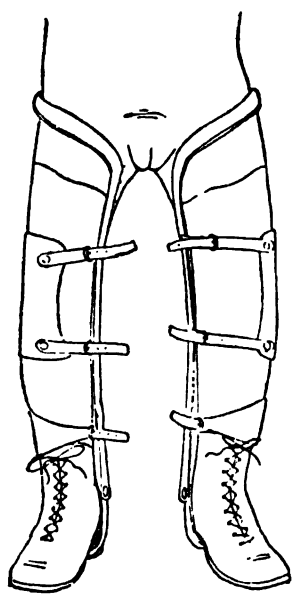


FIG. 194.—Apparutas for bow-legs.—Bradford and Lovett.

child may be seated on a piece of paper, as already described, and a drawing made of the limbs; afterwards from the convex side a "V" shaped piece may be removed until the tracing can be brought straight. This will give an approximate idea of how much of a wedge should be removed from the bone. As a rule, however, it is very seldom necessary to perform osteostomy, osteotomy being sufficient; but in the anterior curvature of the tibia this operation occasionally has to be resorted to.

After the operation the limb should be placed in plaster of Paris bandages and maintained there until healing has taken place, which usually occurs by first intention. Occasionally, through some dyscrasia of the patient, or from impossibility to keep the child quiet, union does not take place and a false joint results. This occurred in one of my cases in the Laura Franklin Hospital. The boy was unruly, and, in spite of all attempts to keep him quiet, would insist upon using his leg. The result was that failure to unite occurred. At a later

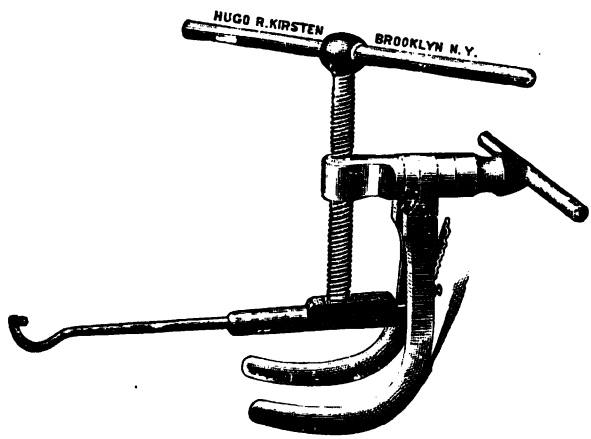


FIG. 195.—Grattan's osteoclast.

period the bone was cut down upon and the two fragments wired together. At that time no attempt, apparently, had been made to unite the ends. No callus had been thrown out and the ends of the bone had become somewhat conical in shape. The wiring was not effective and no good resulted, although the wound healed by first intention, and the child was kept in the hospital for about a year. Finally, by Bier's method, using an Esmarch's band passed lightly about the limbs at a point above the seat of fracture, the return circulation was somewhat impeded, and by this means the nutrition was increased.

and after a long time union took place. This fact, of course, must always be borne in mind in dealing with these cases but such a result is so unusual that it may be practically ruled out in considering the prognosis of operation.

FIG. 196.—Bow-legs.

In nearly all cases of anterior curve where osteotomy or an osteostomy is performed, and the tibia straightened by this method, section of the tendo-Achilles is also necessary.

TALIPES, OR CLUB-FOOT.

Talipes is a permanent deviation of the foot from its normal anatomical relations with the leg. "This abnormal position may consist of flexion, extension, inversion or eversion or a combination of one or more of these, but is popularly applied to that deformity in which the foot is twisted inward so that the weight of the body is turned on the outer side or dorsum of the foot" (Young). In speaking of the position of the foot reference is made to the position of the sole. If the foot is said to be turned outward it is understood that the sole looks outward, and vice versa; so that in describing the various

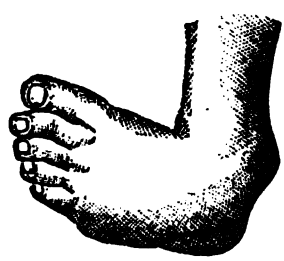


FIG. 197.—Infantile talipes varus.

deformities of the foot it is understood that the sole of the foot is always the part to which reference is made in speaking of the presenting surface. The different simple varieties are:

TALIPES VARUS.—In this variety the foot is turned inward and the patient walks on the outside of the foot.

TALIPES VALGUS.—The foot turns outward and the patient walks on the inside of the foot.

TALIPES EQUINUS.—The heel is drawn up and the patient walks on the ball of the foot.

TALIPES CALCANEUS.—The anterior portion of the foot is elevated and the patient walks on the heel.

TALIPES PLANUS.—The arch is dropped and the foot is flat.

TALIPES CAVUS.—The arch is greatly exaggerated and the foot practically shortened.

Almost any combination may exist, the name of the one most prominent in the deformity taking the precedence, as talipes equino-varus, calcaneo-varus, equino-valgus, etc.

FIG. 198.—Congenital talipes varus in a man of 26.

Talipes may be either congenital or acquired. When congenital it is sometimes inherited, and has been known to afflict families for two or more generations. The children of consanguineous marriages may be afflicted in this manner. I remember seeing in Chicago, a number of years ago, a family where a man had married his own niece who bore five chil-

FIG. 199.—Acquired talipes valgus.

dren; two of them were afflicted with talipes, while the third had talipes and deformity of the knee-joint and was deaf and dumb. Arrest of development is supposed to be one of the causes, and the theory of retarded rotation of the fœtus is now favored by prominent authorities. The theories regarding prenatal influences are too vague and shadowy to afford ground

for scientific belief. Whether intra-uterine pressure, or malposition in utero, or some condition of innutrition is the cause of congenital talipes it is difficult to say. Most cases of acquired talipes are the result of paralysis of certain muscles or groups of muscles from anterior poliomyelitis. In some, the contracted muscles have undergone structural change so that it is impossible to reduce the deformity; in others the contracting muscles are simply using normal force to draw the foot from its correct position. The opposite muscles, having lost their tone, yield to the muscles which contract with their normal strength.

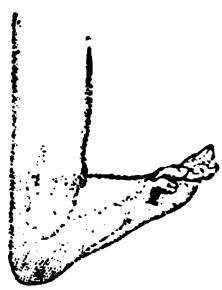


FIG. 200.—Talipes calcaneus.

In talipes varus the deformity consists in a dislocation inward of the anterior part of the foot at the medio-tarsal joint as shown by Sayre. An alteration of all the tissues takes place, due to the abnormal displacement. In congenital cases the muscles are contracted so that it may be impossible to restore the foot to the normal shape. "The muscles are never found paralyzed in congenital club-foot, but the contracted muscles seem more developed than the lengthened muscles." (Bradford and Lovett.) In congenital cases the articulations are irregular, as the scaphoid with the inner and under side of the astragalus, and even with the tip of the internal malleolus. The dislocation of the scaphoid carries with it the rest of the bones

anterior to the medio-tarsal joint, so that the whole anterior portion of the foot is twisted inward. In later life, from long continued pressure, the position and shape of the scaphoid, astragalus, cuboid and os calcis may all be changed. The tendons are abnormally placed.

In old cases much pain is caused by inflammation, pressure and suppuration of synovial bursæ, which form on the outer and posterior portion of the foot, and also from the corns and callosities caused by pressure on the skin in walking. The ligaments are changed and contracted and hold the bones in their abnormal position.

Fig. 201.
Talipes equinus.

Fig. 202.
Talipes equinus, paralytic.

Fig. 203.
Talipes cavus.

The acquired cases are usually the result of "infantile paralysis." Where it occurs as the result of this disease the paralysis may come on suddenly with very few premonitory symptoms. The child may have had a fever which did not appear to have any espceial significance, or it may have continued for three or four days and possibly have been accompanied by convulsions, resulting in paralysis of the limbs. This is due to lesions of certain nerves and inhibits the action of the muscles which they supply. Sometimes the history is very simple. The child goes to bed apparently well, and in the morning it awakens with inability to use one or both limbs. Occasionally the disease is progressive; one limb may be affect-

ed, then two or more; or the leg on the side and the opposite arm be affected; almost any combination of symptoms may exist. The child usually improves after the first onset of the disease, until perhaps only one limb or a portion of one limb may be affected; or the result may be much more grave, and both lower limbs, or even all of the limbs, may be affected permanently. This condition of paralysis may follow exanthematous diseases, such as scarlet fever, measles, whooping cough and particularly cerebro-spinal meningitis and polyomyelitis anterior. Among the causes of the acquired forms are rachitis, injuries to the ankle-joint, burns, which are followed

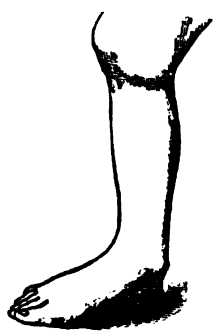


FIG. 204.
Talipes equino-valgus.

FIG. 205.
Talpeis calcaneo-varus.

by extensive cicatricial contraction, and some cases of pseudo-hypertrophic paralysis.

There are certain conditions which are characteristic of talipes. The congenital forms are the most severe. In some of these cases there are deep creases or lines in the sole of the foot, and if an attempt is made to straighten the foot it becomes very much congested and causes the child pain and reflex contraction of the muscles, together with great difficulty in or impossibility of straightening the foot. Here contracture of certain muscles has taken place before the birth of the child.

In mild cases, by careful manipulation, the foot may be easily restored to the normal shape, but the moment the pressure is relaxed the foot goes back to the deformed position. In this case there is simply weakness of the muscles on one side, with normal contraction of the muscles on the other. In very young children there may be no appearance of muscular atrophy, the limbs are well-rounded and do not present the appearance of lack of nutrition, which occurs later on. If the case is one of an older child the appearance may be more characteristic. There may be shrinkage of the affected limb: If only one limb is affected it will be smaller and shorter than its fellow; the

FIG. 206.—Club-foot shoe with elastic traction.

calf of the leg is straight; not rounded and full as on the opposite side. In paralytic cases the foot has a clubbed appearance, may be blue and cold from lack of circulation, with large callosities on the side of the foot on which the patient bears his weight. The patient walks with a rolling gait and with more or less difficulty; in the more severe cases still the limb may be absolutely useless and the patient have no power of locomotion at all. If he attempts to stand on the affected limb he is powerless and likely to fall. In mild cases it may be very easy to restore the limb to its proper position, but the moment the

pressure is removed the deformity returns, while in others the contracture is so firm and so fixed, and the structural change which has taken place in the foot is so great, that it is utterly impossible to bring the limb to a correct position. Interference with the circulation is due to the enervation of the parts; the arteries become smaller and carry less blood than they should, and thus the nutrition is impaired.

In mild cases of congenital talipes much may be done by simple manipulation and straightening of the limb by the hands of the nurse and mother. This should be done several times a

FIG. 207.—Elastic Traction.

day, attempting at each trial to bring the foot to the correct position. These manipulations may cause reflex contractions, if the pressure is made suddenly; but if the nurse is careful, and takes the foot in her hand and quietly presses it around slowly and gently into the correct position, it will be found that the contracted muscles gradually relax to the pressure and slowly allow the deformity to become corrected, and in young children this form of treatment, combined with massage, may be all-sufficient. In slight cases there may exist in the mind of the accoucher a doubt as to whether talipes exists in the infant, when the test which is given by a French surgeon may be of as-

sistance: If a child is undressed and held with its back to an open fire, if there is only a normal turning in of the foot the child will turn the soles of the feet towards the warmth of the fire, bringing them into correct position; but if it is a case of true talipes varus it will be unable to do so, and the deformity will remain uncorrected.

Wherever talipes exists the case should be placed in the hands of a surgeon as early as possible, and in order to correct the deformity the foot should be placed in some form of retaining apparatus. This may consist of plaster of Paris

FIG. 208.—Elastic traction shoe.

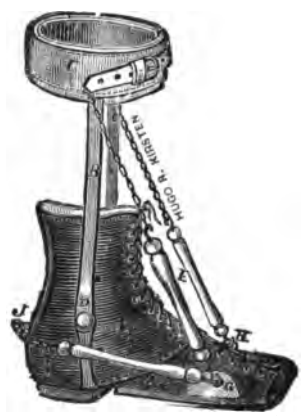


FIG. 209.—Sayre's shoe.

splints, or felt, leather, or wooden splints, any of which may be moulded exactly to the shape of the foot. The advantage of the plaster of Paris is that it can be moulded to the foot, which is maintained without difficulty in the corrected position. The disadvantage is that it must be kept on constantly and cannot be removed for the purpose of daily manipulation or massage. The splints which can be made of leather or of felt do not have this objection, as they can be removed at any time and the massage of the foot be carried on, nutrition being thereby improved.

Where the plaster of Paris splints are used they should be frequently renewed, because while the deformity is in part corrected at one sitting and still more at the next, the advantage which is gained at one time should be followed up as rapidly as possible. In many cases a foot which may be very much misshapen at birth may be brought around to a correct position. Where the leather or felt splints are used they should be removed every day. The foot should be bathed, rubbed and electricity applied to the weakened or paralyzed muscles so that the foot is straightened, and, at the same time, its growth is not prevented. When the deformity has been corrected, which may be accomplished at any time before the child begins to walk, some form of corrective apparatus should be applied. A form of club-foot shoe is the best, something which has an elastic traction tending always to bring the foot into the normal position. Barwell's method of applying straps of adhesive plaster with artificial muscles of rubber has been advocated for use in the early stages, but has certain drawbacks. The skin of the child is so delicate that it is difficult to make the application of adhesive straps without causing excoriation of the skin, and other forms of treatment seem preferable.

The variety of shoes which may be applied so that the patient can walk about are many. In some of them there are very ingenious arrangements of keys, pivots, ratchets, straps, joints, splints and artificial muscles, all of which more or less resemble the instruments of torture found in the Tower of London, and are equally efficacious in producing pain and discomfort unless applied by skilled hands. The simpler the form of apparatus which can be utilized in the treatment of these deformities the better, because where these complicated instruments have to be applied much pressure has to be brought to bear upon the limb, and thus the nutrition is still further im-

paired. It is of the greatest importance to apply some form of apparatus as soon as the child is old enough to walk about.

Harry M. Sherman,* of San Francisco, thus describes and illustrates a simple but useful shoe: "The form of varus walking shoe I have been using for the past six years I find has been described and illustrated by Dr. B. E. McKenzie, of Toronto, in Vol. IV., of the Transactions of this society. It is essentially a spring-heel shoe, the outer border of the sole being con-

FIG. 210.—Varus shoe and outrigger.

siderably thicker than the inner—so as to throw the foot into a valgus position—and with the counters extending past the metatarso-phalangeal articulations on both outer and inner side to keep the metatarsus and phalanges in line with the tarsus. In some obstinate cases where the foot still shows a tendency to roll over on the outer edge, I have added a little curved strap

*Transactions of the American Orthopedic Association, Vol. VI., 1893.

of steel, set flush with the sole and extending out beyond the outer edge, like an outrigger. This outrigger very effectually checks the tendency to roll over, and can be worn with no inconvenience until joint surfaces are readjusted in their normal relations and the tread is easily plantigrade."

The general health depends largely upon exercise and freedom of movement, and if this is restricted the child becomes fretful, irritable, and general depression of the system is likely to follow. As auxiliaries to the treatment the application of massage, warm baths, dry heat, the use of electricity—espe-

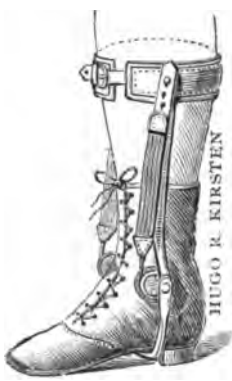


FIG. 211.

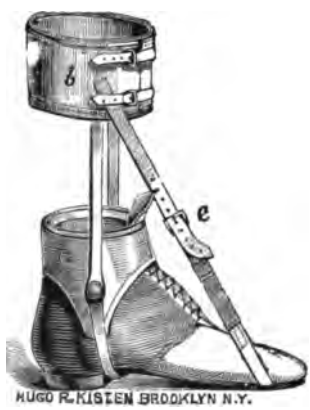


FIG. 212.

Shoes for talipes equinus.

cially of galvanism—to the motor points should be faithfully kept up. In advocating the use of electricity it should be understood that it is to be used with great care and skill. Electricity is one of the most potent agents we have in the treatment of these cases, but its misuse gives rise to great damage and retards the ultimate cure of the case. The application of the ordinary battery in a case of this sort is worse than useless, and electricity should not be applied without the advice of one who thoroughly understands it. Frequently it will be found

that certain muscles or groups of muscles are paralyzed, while the entire limb is not affected, and by the application of electricity to the motor points of these muscles the foot may be drawn into proper position. A careful expert examination of these cases is positively necessary, and a perfect understanding of the conditions present is most important. The group of muscles should be carefully tested from their motor points, and those which are weak should be strengthened and their nutrition increased until they are equal in action to the healthy muscles. In some cases it may require long-continued treatment before it can be ascertained that there is any contractility remaining in the muscles, but by care and perseverance faint contraction may finally be elicited, and if this is possible the restoration of the muscles to their proper use is feasible. In cases where contracture of certain muscles has taken place and the deformity cannot be reduced by manipulation the only relief that can be found is in some form of operation.

In many cases the operation of tenotomy or fasciotomy may be required. In cases of talipes equinus a division of the tendo-Achilles will allow immediate correction of the deformity. In cases of talipes varus cutting of the tibialis anticus, extensor pollicis, and possibly of the extensor communis digitorum may be required. In cases of talipes cavus the operation of fasciotomy or division of the strong longitudinal bands on the sole of the foot and tenotomy of the tibialis may be necessary; while in severe cases of flat-foot it may be necessary to divide the peroneal muscles. Where the operation of fasciotomy is performed it should be done subcutaneously and with great care. Some operators advise the open incision in case of tenotomy. I see no necessity for such an operation, because it is usually easy to find the tendon and cut it, making only the very

slight incision required for the introduction of the tenotome, thus allowing no infectious material to enter the wound; while with open incision there is not only the danger of infection, but always a very much larger cicatricial area, which may cause adhesions and prevent the action of the muscles. The operation of tenotomy is easily performed. The knife used is the ordinary tenotome, either sharp or blunt pointed as the surgeon prefers. What is known as a "valvular" incision is preferable because it adds another safeguard against the introduction of infection into the wound. When the tendon has been divided the foot is restored to the correct position and a little plug of gauze, wet in bichloride of mercury solution, is placed over the wound; then the foot is wrapped in plaster of Paris bandages which have been soaked in the bichloride solution. This renders the dressing perfectly antiseptic, and it is seldom that any trouble follows the operation. The old method of leaving the foot in the deformed position until the wound has healed is not advised to-day, because it is much more difficult afterwards to bring the foot to the correct position, while if corrected at the time of the operation plastic material fills in between the two ends of the divided tendon, making a continuous length so that when this plastic material becomes hardened the tendon has not diminished in strength, while the requisite new tissue for an addition in length has been gained. The plaster of Paris splint may be removed at the end of a week or ten days, and by that time the external wound is usually found perfectly healed. While the foot may be sensitive for a few days the patient may be allowed to walk about on it without danger. The operation of fasciotomy is more extensive. The child is laid on the table face downward; the foot is put on the stretch by an assistant, and the surgeon feels with his finger for the points of contract-

ed tissue. The knife is introduced with the flat side parallel with the longitudinal bands, and is then turned so that by a sawing motion the band is cut in two. When one band of fascia has been cut others spring into view, and it may require several punctures and quite extensive cutting in the sole of the foot in order to relieve the deformity. As a rule, there is but slight hæmorrhage, but occasionally through the abnormal distribu-

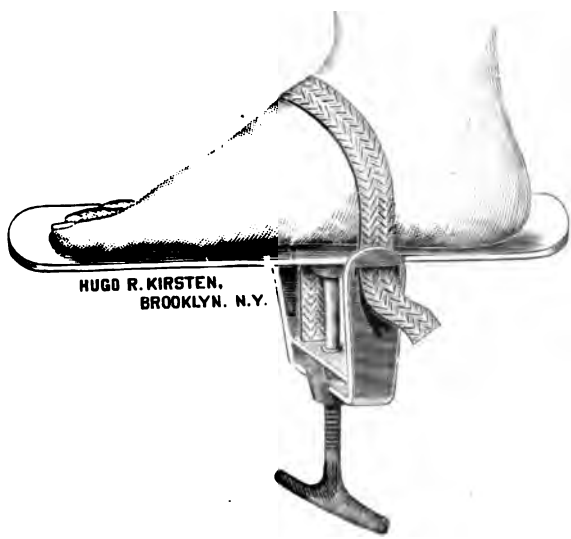


FIG. 213.—The author's apparatus for bringing down the arch.

tion of some small artery the bleeding may be quite extensive. In cases where it cannot be stopped by pressure it may be necessary to make an open incision, find the artery and tie it. Occasionally where an artery has been wounded in the sole of the foot a traumatic aneurism has formed and requires operation at a later period. Operations of tenotomy and fasciotomy may be only preparatory to the treatment which must be employed to restore the function of the foot, and this must consist of electricity, massage, application of heat, etc., as already mentioned.

In severe cases the following measures are employed: The open incision, the use of extreme force, tarsal osteotomy and tarsal resection. The operation by open incision consists of a more extensive division of the fascia and of the soft parts of the foot than would be included under the term of "fasciotomy," and instead of being sub-cutaneous the foot is cut across, dividing the soft structures thoroughly so that the resistance is overcome. This open incision, which was first advocated by Phelps, is begun by dividing the skin along the inner side of the foot from the top of the malleolus low down on the inner side of the first metacarpal bone, the tibialis tendon is then cut across and the artery may be divided. The foot is brought into normal position and the wound packed with iodoform gauze and fixed in plaster of Paris bandage. It is sometimes very difficult, even with extensive incisions, to relieve the deformity and a great deal of force may be required to restore the distorted foot to a correct position, but it should be brought as nearly to the normal as possible and allowed to heal by granulation. The operation should be done aseptically and the foot kept in position until the wound has healed. There is a great tendency for the cicatrix to contract and draw the foot around in a deformed position again; this can be avoided by the use of plaster of Paris or leather splints, or by the use of one of the forms of club-foot shoes.

The use of extreme force is employed where it is inadvisable to perform the operation of tenotomy, and under an anæsthetic instruments are used which are in reality powerful wrenches. These take strong hold of the foot and sufficient leverage is gained by the use of the apparatus so that the foot can be twisted around into the correct position. There are various forms of apparatus of this sort which are

used, as Morton's club-foot stretcher, the lever correction apparatus, and Thomas' wrenches. The object is to tear or stretch the contracted tissues to such an extent that the foot may be straightened.

Of late in very young children I have used manual force to straighten the foot, which is afterwards retained in place by plaster of Paris splints. This is done under full anæsthesia. The force is great enough to tear the contracted ligaments.

The bandage should be carried above the knee and up the thigh, and the leg should be flexed at the knee to prevent rota-

FIG. 214.—Result after Phelps's operation.—McKenzie.

tion of the foot. In some cases these operations may be supplemented by tenotomy or fasciotomy. Successful cases are reported by Wolf, Bradford, and Lovett, and others.

TARSAL OSTEOTOMY.—The methods employed in tarsal osteotomy have been grouped by Bradford and Lovett, as follows:

Removal of the cuboid alone; removal of the astragalus alone; removal of the astragalus and cuboid and scaphoid; section of the neck of the astragalus; removal of the astragalus and the external malleolus; osteotomy of the lower end of the tibia and fibula; wedge-shaped resection of the tarsus. According to these authors the results from the first method have not been altogether satisfactory; the fourth may be said to be insufficient; and against the third and sixth may be urged that

too much mutilation of the foot results. Authorities differ in the advocacy of the second and seventh methods.

The following description of the operation of excision of the tarsus in club-foot is given by Bradford and Lovett:

An Esmarch bandage is applied to the foot and an excision is made along the outer border from the middle of the os calcis to the middle of the fifth metatarsal bone. This is joined at right angles by another incision across the dorsum of the foot, the soft parts being reflected. The cuboid is first removed, then a wedge-shaped portion of the tarsus, of sufficient size to allow the foot to be brought into proper position without much force, is excised. The wedge of the bone which may be removed with a chisel or saw, should have its base of a width corresponding to that of a cuboid, and should be rather thicker above than at its lower surface. The operation should be performed with the strictest antiseptic precautions, after which the foot should be held in the corrected position and fixed by means of a plaster of Paris bandage, or some other efficient form of fixative appliance. The authors named have used a splint made of strong iron wire, instead of using plaster of Paris, the foot being held in place by means of adhesive plaster. Inversion of the foot is prevented by winding plastic strips around the leg. This operation, although apparently one of great severity, is followed by good results. The foot may be restored to its correct position so that the patient instead of walking on the side of his foot is able to walk on the sole. There are some objections made to this operation, such as a certain amount of risk and the removal of all chance of restoration of the foot by orthopedic methods. But these objections are fully met by the fact that the operation would only be performed in cases where no other method could be employed, and it is perfectly

justifiable to give the patient the benefit of the operation; even though it does involve a certain amount of risk.

Osteotomy may be performed for the restoration of the foot where the astragalus has been deformed by the action of long-continued pressure. Astragalus-osteotomy is described as follows by Bradford, the author of the operation. "The procedure," he says, "will not be found a difficult one." It should be done with the foot stretched and manipulated into nearly as normal a position as possible. An incision through the skin is

FIG. 215.—Line of incision and position of foot after Phelps's operation.—McKenzie.

FIG. 216.—Position of foot after Phelps's operation, showing large bursa on outer side of foot.—McKenzie.

made from the top of the malleolus to the inner side of the head of the first metatarsal, which will be found in severe cases close to the malleolus. The scaphoid will be seen before the astragalus is encountered if the deformity is great, and it will be first in reach of the knife in all cases. If the foot is still further stretched, as the scaphoid begins to uncover the side of the astragalus the neck of the astralagus is seen. A small osteotome is entered and placed upon the neck of the

astragalus to the distal end and the neck of the astragalus divided, or nearly divided. The foot is then forcibly straightened, and the neck of the astragalus is chiseled and fractured. The result is similar to that in Macewen's operation for knock-knee, the distortion about the neck of the astragalus being removed. It is manifest that the line of section of the bone at the neck of the astragalus should be transverse to the axis of the bone, and at such a plane that when the equinus deformity is corrected the resulting gap at the section will not be greater than necessary. The foot should be fixed in the corrected position. In many cases of operation for club-foot the after-treatment is quite as important as the operation in order to secure a permanent result. There is frequently a tendency toward return of the deformity from re-contraction of the tissues, and it is necessary to use some form of retentive apparatus for a considerable time, until this tendency has disappeared. Where there is a constant inclination of the foot to return to the position of varus after operation the club-foot shoe should be used. Later on a device which tends to throw the outside of the foot up may be applied. This may consist of a semi-circular piece of steel which is fastened to the outer side of the sole of the foot in such a manner that the patient, in walking, strikes this steel first and the foot is thrown outward. (See Fig. 210.)

In cases of paralytic talipes where only groups of muscles are affected, very good results may be obtained by transplanting slips from the tendons of the normal muscles to the tendons of the affected ones. In this way the foot may be brought into the correct position, and the transplanted tendon carries on the function of the paralyzed one.

To accomplish this the tendons of both muscles are exposed by longitudinal incisions. The tendon of the active muscle is

cut half way through and split proximally as far as may be necessary. Then the slip is carried across to the tendon of the paralyzed muscle.

This tendon is split and into the slit the slip from the other tendon is inserted and fastened by a few sutures of fine silk or chromicized gut. Thus a slip of the extensor proprius pollicis may be fastened to the tendon of the anterior tibial. a slip from the short peroneal to the extensor communis digitorum. A slip from ex. com. digitorum may be attached to the ex. prop. pollicis, or a tendon from either the flexor longus digitorum or the peroneus longus to the tendo-Achilles. Also a slip from a sound anterior tibial may be carried subcutaneously across the top of the foot and attached to the fascia covering the tarsus on the outer edge of the foot in a case of talipes varus.

Many more combinations may be made up, the conditions necessary for success being a knowledge of the action of the various muscles, the fact that tendons from sound muscles are obtainable, and also that their action may not conflict with that of the muscle which they are to assist.

FLAT-FOOT.

Flat-foot is occasioned by depression of the bones of the arch of the foot. It is a mild form of talipes valgus. Frequently from paralysis of certain muscles, notably the tibialis anticus and the extensor longus pollicis or extensor primalis digitorum, and from weakness of the ligamentous structures which hold the bones in their proper position, the arch of the foot gives way and is pressed downward to the floor in walking. This not only gives rise to deformity, making the foot appear ugly in shape, but also occasions severe pain to the patient. The deformity consists not alone in the loss of the

arch of the foot, with its natural and graceful contour, but also in a displacement of the astragalus downward and inward so that it projects from the inner side of the foot, giving an exceedingly ugly appearance. The displacement of the bones frequently causes severe pain to the patient in standing. In the correct position of the bones the articular surfaces are free from nervous or vascular structures, these being placed at the sides where pressure upon them is avoided, but when displacement takes place the edges are brought into apposition so that these sensitive structures are pinched between the sharp corners

FIG. 216.—Medium degree of flat-foot.

of the bone. This causes the severe pain that is felt when the patient is standing, and explains the relief which he receives when the foot is restored to its position, either by pressure with the hand or by standing on some substance which raises the arch. The pain is usually quite severe and is felt across the top of the foot, sometimes radiating downward towards the toes or underneath the foot. The projection of the astragalus is often mistaken for some abnormal growth and frequently treated as such, when by simply pressing the foot around into the correct position the deformity at once disappears.

In cases where the deformity is paralytic, or where it is due

to the weakness of the muscles on the anterior portions of the leg, treatment by electricity and massage is of the greatest benefit. The foot should be restored to its normal position and be kept so by some form of apparatus which can be placed

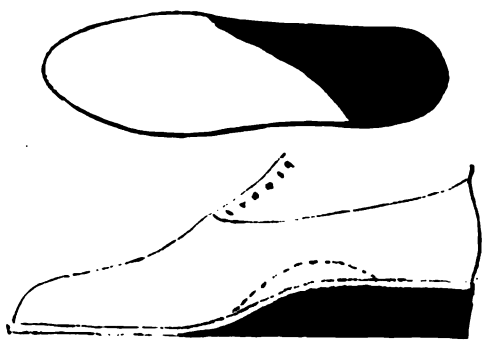


FIG. 217.—An orthopedic shoe used in Germany. The heel on the inner side is carried forward to support the arch. The dotted lines indicate the amount of building up which is done inside the shoe.

within the shoe. Frequently children suffer from this condition, and in such cases the application of a steel spring or a piece of cork to the inner side of the shoe may be all that is

FIG. 218.—Severe flat-foot.

FIG. 219.—Steel support for flat-foot.

necessary to raise the arch. In some cases it is necessary to use a brace which consists of two steel bars running up the inner and outer side of the leg, the strap being attached to the outer side of the sole, running across it and up and out from the

inner side of the shoe and fastened to the top of the inner bar of the brace. By tightening this strap the arch of the foot may be raised to the necessary height to overcome the deformity.

ANKLE-JOINT DISEASE.

The ankle-joint is subject to the same form of tubercular disease as the knee or hip-joint, and there is no especial difference as regards the pathological or etiological conditions. A tubercular disease of the ankle-joint, however, is likely to invade a large amount of bony tissue, as the spongy portions of the tarsal bones, and so many joints are involved between these small bones that healing may result in complete loss of function. When suppuration sets in the disease may affect a large number of bones, and operative procedures which attempt the removal of the diseased bones may be so extensive that many of the tarsal joints are completely removed, when, if healing can be induced, complete anklyosis of the joint will probably result. The general symptoms may be much the same in character as those of hip-joint and knee-joint disease, only perhaps less severe, and the general effects of the disease may be similar as regards the joint itself.

The treatment of tubercular ankle-joint disease is by method similar to those employed in diseases of the other joints. It is easier to apply the retentive apparatus than it is in the case of the other joints, but more difficult to apply extension, on account of the difficulty of getting a proper hold on the foot. To immobilize the joint, splints of plaster of Paris or felt or any other of the materials which are used ordinarily are easily applied. Of course, the patient should not be allowed to bear his weight on his foot, and if he goes about it

should be on crutches, with a high shoe on the opposite foot. The use of continuous cold is recommended.

The operation of excision is done largely with a curette or the flushing gouge rather than with a chisel or knife or saw, and in all other cases the diseased focus should be as thoroughly removed as possible. If an unopened abscess is present the same form of treatment as that indicated for the other joints may be employed, but the treatment of these cases is ex-

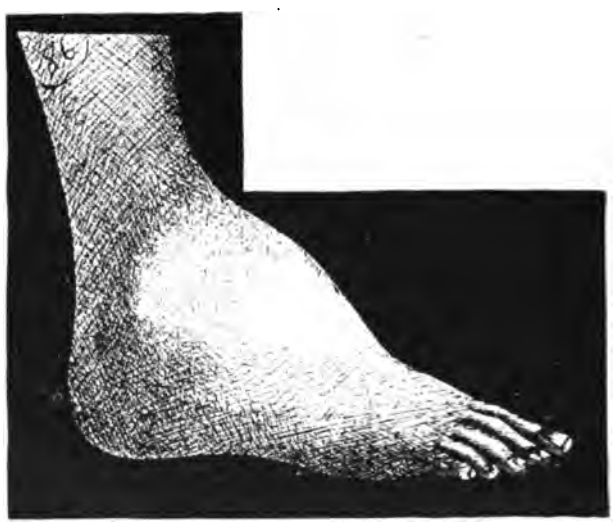


FIG. 220.—Diseased ankle.

ceedingly tedious and extends over a considerable time. Frequently patients do not suffer from so great constitutional disturbance as they do in the disease of the other joints, but it is likely to be a long time before a cure is effected.

I believe the solution of iodoform in ether and oil as described in the chapter on tubercular peritonitis, would be useful here, and also in tubercular diseases of the knee-joint.

DISEASE OF ELBOW AND SHOULDER JOINTS.

The elbow-joint and shoulder-joint are also liable to tubercular disease, and manifest the same general symptoms as in the diseases before mentioned, and the particularly marked symptoms in all cases is the limitation of motion. In some cases of elbow-joint disease there may be slight flexion, with some swelling and bogginess about the joint, but with little pain. Abscess may form and even general tuberculosis finally result. If excision is resorted to it should be employed early, as the author has observed a late excision of the elbow-joint followed by reinfection, necessitating amputation of the thigh for disease of the knee-joint, and finally death from general tuberculosis. In another case where an apparently thorough excision was made of the elbow-joint the disease persisted, infection ensued, and an amputation at the shoulder-joint about a year afterward saved the patient's life.

TREATMENT.—Extension may be employed and much more easily than in the case of the lower limb. The application of cold and all the other remedial measures which have already been mentioned for treatment of tubercular abscesses may be employed. The excision of the shoulder-joint is likely to be accompanied by better results than in the case of the elbow-joint. After excision of the elbow-joint there is likely to be a flail-joint resulting, because it is impossible to reproduce in the joint the depressions of the condyles and process which exist in these normally. In the shoulder-joint, however, which is a ball and socket, the incision is easily made and the new head of the humerus which is produced fits sufficiently well into the glenoid cavity so that the resulting joint is very serviceable, and there may be no special impairment of function. In cases of tuber-

cular disease of the elbow- or shoulder-joints the author urges the prolonged application of cold. It is easily applied and kept in position, and the patient can go about with little or no trouble.

WEAK MUSCLES.

Parents frequently wonder at the peculiar gait of their children. They notice that they toe in, that they have a shambling gait, and that all these symptoms increase if the child is tired. This they attribute to carelessness on the part of the child, and endeavor by discipline, urging, and constant admonition, to have him exert himself to overcome this apparent shiftlessness. But there are actual pathological conditions which enter into the production of these symptoms which are always the result of weakened muscles or of diminished nervous power. If the muscles of one side of the child's limb are normally strong and those on the other side are weak the result will be that the strong muscles, acting easily and normally, maintain their correct attitude under all conditions, while the weak muscles, which may be kept in line by the action of the will of the patient, soon tire and are overcome by the opposing strong muscles. A child is told to walk with his toes turned out. He does so as long as his attention is kept on it, but as soon as his attention is diverted the strong muscles involuntarily incline the limb to the abnormal position. In walking it may be observed that he goes with a leg slightly flexed, and this may continue through life. People are often observed who walk with an awkward gait, and the same symptoms which are observed in childhood, as toeing-in. One leg is apparently shorter than the other, but on close observation it may

be observed that in walking the subject does not fully extend the leg when he throws it forward; this is due to weakness of the muscles on the anterior portion of the thigh, and unless treated and the muscles evened up this person will always have the awkward gait described.

FIG. 221.—Sinusoidal apparatus.

The use of the sinusoidal apparatus and vibratory massage are attended with great benefit and increased growth of the muscles if properly applied.

Little attention has been paid to this subject, but within the past few years I have been giving special attention to it and it is found that frequently the effect on the general tone and disposition of the patient is quite marked. In some cases where

before the muscles were evened-up it was noted that the patient was morose, and easily tired, after the treatment by massage and electricity until the muscles were properly balanced there was complete change in the mental condition. This subject is one which should receive more attention at the hands of physicians, and in many cases where the mental condition has been attributed to a constitutional perversion, or where the awk-

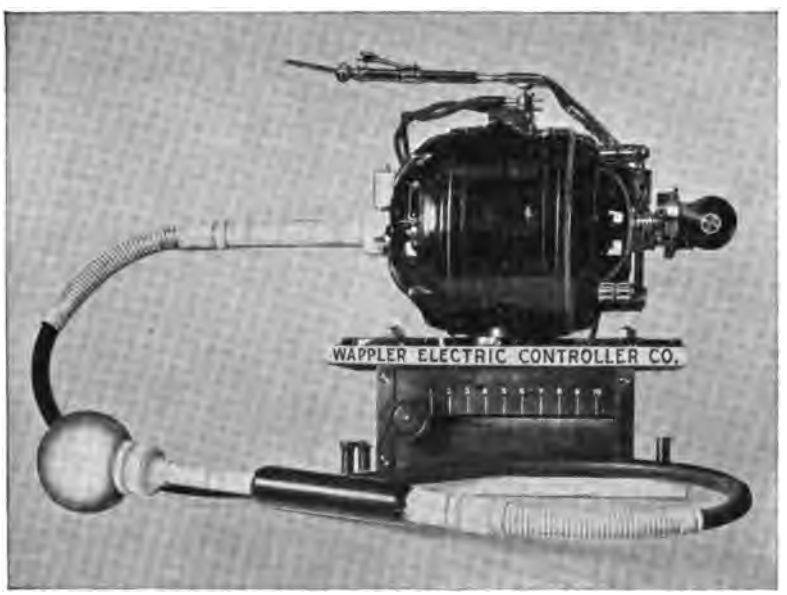


FIG. 222.—Electric vibrator.

ward gait has been attributed to laziness on the part of the patient, it may be found that an actual pathological condition exists which has caused these symptoms.

The treatment should be active, the patient should receive such remedies as have a tendency to build up and strengthen the general system, and he should not be kept closely confined to school. Massage and electricity should be applied, and the latter is probably the most active agent in the restoration of the

muscles. It cannot be applied indiscriminately by everyone, and when it is applied it should be done by one who understands the picking out, and differentiation and comparison of the various muscles from their motor points. He should also be thoroughly conversant with the method of treatment by means of the galvanic or faradic electricity.

One of the most healthful exercises which can be employed is riding the bicycle. The author is very much in favor of the use of this vehicle for children who require stimulation and exercise. It is healthful and invigorating, and it gives an exhilaration to the mind and body, it gives them an impetus to take exercise which they would not otherwise have, and in cases of lateral curvature, or in any condition where the weakness is due to a general lack of muscular tone, there is probably no means of general stimulation and invigoration better than this.

HALLUX VALGUS.

In this condition the great toe is twisted outward, and it may be to such an extent that it either overlaps or is covered by the other toes.

As a result of this distortion the joint becomes very prominent and from the irritation of the skin, callosities, which are known as bunions, form over the joint. Also the head of the first metatarsal bone becomes much enlarged, and often sharp, spike-like growths of bone develop, which press against the inflamed skin and cause intense pain.

In some cases the bursa over the head of the bone inflames and suppurates and a fistulous opening results.

CAUSES.—Hallux valgus is usually found in patients beyond youthful age, but is occasionally found in young people as the

result of wearing too short shoes, which they have outgrown. Pressure of a tight shoe over the joint may cause the joint to inflame, especially if the shoe is pointed and short. A long pointed shoe will cause no trouble providing the inner side of the shoe is straight. It is not necessary to have a shoe ugly in shape in order to have it comfortable or healthful for the foot. Rheumatism and gout are frequent causes.

It is not a condition usually found in children, but as improper methods of shoeing children are responsible for it, the subject is mentioned here.

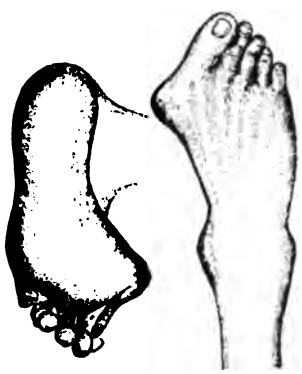


FIG. 223.—Hallux valgus in an elderly woman.

The pain arising from hallux valgus is often excruciating in character, and especially in warm or stormy weather, and the sufferer sometimes becomes almost desperate from the pain.

TREATMENT.—Various forms of apparatus have been employed with the intention of drawing the great toe from its abnormal position, but as a new joint has practically formed by the time they come into the hands of the surgeon these devices are of little use, although they may give relief. The operation of resection of the head of the metatarsal bone restores the toe to its proper position. It is claimed by some

authors that it must be performed with caution, as in some cases the results have been bad. Some writers claim that only flat-footed patients should have the operation. In several cases in which the author has operated the results have been satisfactory. A longitudinal incision is made through the integument down over the joint to the bone. The soft parts are dissected away and the head of the bone freed. It is then clipped off with a pair of bone forceps and all sharp points trimmed away. The wound is closed, the joint capsule being stitched up first with buried sheep-gut sutures. In order

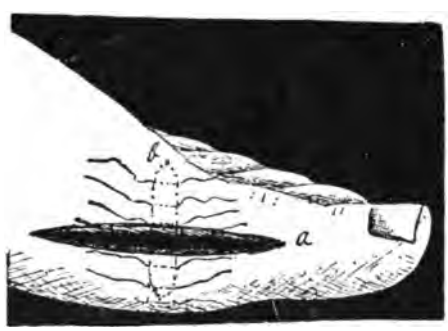


FIG. 224.—Author's operation for hallux valgus.

to bring the toe into correct position and hold it there the writer shortens the capsule by stitching crosswise, thus bringing the base in direct apposition with the end of the metatarsal bone: a, shows longitudinal incision through capsule; b, with dotted line, showing same stretched crosswise in order to shorten outer side of capsule.

The external opening may be stitched longitudinally and before it is done the hardened skin should be removed. A plaster of Paris cast is applied to hold the toe, and is retained in position about ten days. The patient should not be allowed to put the foot down until healing is complete.

HAMMER TOES.

Hammer toe is the term applied when the first phalanx is extended and the others flexed. It occurs most frequently in the second toe. It may be due to too short or narrow shoes, and sometimes it is difficult to assign a cause, while in many cases it is probably of paralytic origin.

FIG. 225.—Hammer toes.

TREATMENT.—A sandal which holds the toes in position may be used. Digitated stockings, electricity and massage may help.

In some cases tenotomy may be required to bring the toe into proper position. In some cases amputation of the toe is the best and quickest method of cure.

WEB FINGERS.

When two adjoining fingers are united it is a congenital condition of webbed fingers.

It can be relieved only by an operation, and the difficulty in the operation lies in preventing the web from growing again from the angle, and in covering the raw surfaces after separating the fingers. The devices shown in the cuts explain them-

selves. The author has been able by applying a Theirsch's graft to cover the raw surface satisfactorily, and thinks this

FIG. 226.—Dorsal flap brought through between fingers and stretched on the palmer side. Also wound closed on opposite side of fingers.—Agnew.

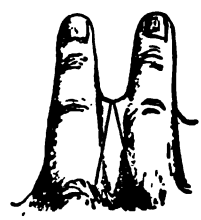


FIG. 227.—Form of incision for webbed fingers.—Agnew.

FIG. 228.—Didot's operation for syndactylism.

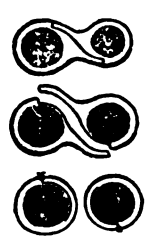


FIG. 229.—Didot's operation for syndactylism, represented in cross section.

in connection with Agnew's device for covering the apex of the incision superior to Didot's operation.

TOEING-IN.

Toeing-in may be caused by weakening of the external rotators of the thigh, and may exist to such a degree that it is impossible for the patient to turn his toes out.

Electricity is probably the best remedy, and the assistance of an apparatus may be required. It should be borne in mind that no apparatus is of use in inverting or everting the foot unless it has a pelvic band from which to obtain its leverage, unless the toes are forced apart by some of the clumsy arrangements occasionally, but not wisely, resorted to. Doyle's spring rotator is probably the best form of apparatus for this condition.

PSEUDO-HYPERTROPHIC PARALYSIS.

This condition is one requiring medical rather than surgical treatment, although a brace may be of use in preventing the distortion resulting from the final muscular atrophy. The disease occurs most frequently in young boys, whose buttocks and thighs become greatly enlarged. If placed prone upon the floor and told to get up, the child will be unable to do so, unless he first raises himself on his hands and knees, then, still keeping his hands on the floor, he struggles to his feet and hands, and, finally, gains the erect position by pushing himself up, by placing his hands on his thighs to do so.

Atrophy follows the enlargements of the muscles.

The chief symptoms are the enlargement of the parts mentioned, the waddling gait, the lordosis, the difficulty experienced in going up stairs, and in rising from the prone position.

Bartlett (Practice) advises the child be kept as quiet as

possible in the early stage of the disease, and the limbs wrapped in cotton. The use of electricity should be avoided in the early stages, but may come in late, to stimulate the muscles. In the early stages Raue (Diseases of Children) recommends Bel., Acon., Bry., Gels., and Rhus tox. Later, Mercurius and Plumbum may be indicated.

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